

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Lynette T. Umez-Eronin Examiner #: 74987 Date: 12/6/01
 Art Unit: 1765 Phone Number: 306-9074 Serial Number: 09/749191
 Mail Box and Bldg/Room Location: CR3, 10E12 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the selected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Prevention of precipitation defects on copper intercon-
nects during CPM by use of solution.
 Inventors (please provide full names):

Kashmir S. Sahota, Diana M. Schonauer, Johannes F. Garoschopf,
Gerd F. C. Marxsen, and Steven C. Avazino
 Earliest Priority Filing Date: 11/4/98

For Sequence Searches Only Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

~~PA # 56281/209~~

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STAFF USE ONLY

Searcher: JDC
 Searcher Phone #: X-4139
 Searcher Location: ETC 1760
 Date Searcher Picked Up: _____
 Date Completed: 12/13/01
 Searcher Prep & Review Time: 40
 Clerical Prep Time: 15
 Online Time: 125

PTO-1590 (8-01)

Type of Search

NA Sequence (#) _____
 AA Sequence (#) _____
 Structure (#) _____
 Bibliographic ☒
 Litigation _____
 Fulltext _____
 Patent Family _____
 Other _____

Vendors and cost where applicable

STN ☒
 Dialog _____
 Questel/Orbit _____
 Dr. Link _____
 Lexis/Nexis _____
 Sequence Systems _____
 WWW/Internet _____
 Other (specify) _____

L7 17 SEA FILE=REGISTRY (107-21-1/BI OR 111-46-6/BI OR 156048-32-7/BI
OR 25067-34-9/BI OR 25213-24-5/BI OR 25322-68-3/BI OR
25791-96-2/BI OR 31694-55-0/BI OR 50-70-4/BI OR 56-81-5/BI OR
7631-86-9/BI OR 9002-89-5/BI OR 9002-92-0/BI OR 9003-05-8/BI
OR 9004-95-9/BI OR 9016-45-9/BI OR 9063-89-2/BI)

L8 69893 SEA FILE=REGISTRY 1,2,4-TRIAZOLE

L9 1 SEA FILE=REGISTRY SILICA/CN

L11 38677 SEA FILE=HCAPLUS BTA OR POLYANILINE OR PURINE

L12 28479 SEA FILE=HCAPLUS L8

L13 73119 SEA FILE=HCAPLUS BENZOTRIAZOLE OR IMIDAZOLE OR ?BENZIMIDAZOLE
OR INDIAZOLE

L14 136239 SEA FILE=HCAPLUS L11 OR L12 OR L13

L15 16 SEA FILE=REGISTRY L7 NOT L9

L16 205585 SEA FILE=HCAPLUS L15

L17 40463 SEA FILE=HCAPLUS PVA OR PAA OR PEG OR GEO OR DMSIO-EO OR GPO
OR DCA OR PEI

L18 622895 SEA FILE=HCAPLUS POLYVINYL ALCOHOL OR VINYL ACETATE OR
POLYETHYLENE OR SORBITOL OR GLYCEROL OR POLYACRYLAMIDE OR
ETHYLENE GLYCOL OR GLYCEROL ETHOXYLATE OR DIMETHYLSILOXANE OR
POLYETHYLENE OXIDE OR OCTYLPHENOL OR NONYLPHENOL OR POLYOXYETHY
LENE

L20 6480 SEA FILE=HCAPLUS L14 AND (L16 OR L17 OR L18)

L22 1 SEA FILE=REGISTRY TANTALUM/CN

L23 35158 SEA FILE=HCAPLUS L22

L24 104062 SEA FILE=HCAPLUS TA OR L23 OR TANTALUM

L31 9649 SEA FILE=HCAPLUS CMP OR CHEM?(2A)MECH?(3A)POLISH?

L34 68931 SEA FILE=HCAPLUS L31 OR POLISH?

L35 50 SEA FILE=HCAPLUS L34 AND L20

L36 3 SEA FILE=HCAPLUS L35 AND L24

=> d all hitstr 1-

YOU HAVE REQUESTED DATA FROM 3 ANSWERS - CONTINUE? Y/(N):y

L36 ANSWER 1 OF 3 HCAPLUS COPYRIGHT 2001 ACS
AN 2001:763349 HCAPLUS
DN 135:309344
TI System for the preferential removal of silicon oxide
IN Mueller, Brian L.; Chamberlain, Jeffrey P.; Schroeder, David J.
PA Cabot Microelectronics Corporation, USA
SO PCT Int. Appl., 20 pp.
CODEN: PIXXD2
DT Patent
LA English
IC ICM H01L021-00
CC 66-4 (Surface Chemistry and Colloids)
Section cross-reference(s): 76
FAN.CNT 1

| PATENT NO. | KIND | DATE | APPLICATION NO. | DATE |
|---|------|----------|-----------------|----------|
| PI WO 2001078116 | A2 | 20011018 | WO 2001-US11604 | 20010409 |
| W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM | | | | |
| RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG | | | | |
| PRAI US 2000-547425 | A | 20000411 | | |

- AB A system, a compn., and a method for planarizing or **polishing** a composite substrate are provided. The planarizing or **polishing** system comprises (i) a **polishing** compn. comprising (a) .apprx.0.5 wt% or more of F- ions, (b) .apprx.1 wt% or more of an amine, (c) .apprx.0.1 wt% or more of a base, and (d) H2O, and (ii) an abrasive. The present invention also provides a method of planarizing or **polishing** a composite substrate comprising contacting the substrate with a system comprising (i) a **polishing** compn. comprising (a) .apprx.0.5 wt% or more of F- ions, (b) .apprx.1 wt% or more of an amine, (c) .apprx.0.1 wt% or more of a base, and (d) H2O, and (ii) an abrasive.
- ST **polishing** planarizing composite semiconductor substrate preferential removal silicon oxide
- IT Abrasives
(additives of compns.; system, compn. and method of planarizing and **polishing** for preferential removal of silicon oxide)
- IT Amines, processes
RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(additives of compns.; system, compn. and method of planarizing and **polishing** for preferential removal of silicon oxide)
- IT Alcohols, processes
RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(amino, compn. for **polishing**; system, compn. and method of planarizing and **polishing** for preferential removal of silicon oxide)
- IT Mixing
(blending abrasive in **polishing** pad; system, compn. and method of planarizing and **polishing** for preferential removal of silicon oxide)
- IT Surfactants
(compn. for **polishing**; system, compn. and method of planarizing and **polishing** for preferential removal of silicon oxide)
- IT Chlorates
Chromates
Permanganates
Peroxides, processes
Peroxysulfates
Tannins
RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(compn. for **polishing**; system, compn. and method of planarizing and **polishing** for preferential removal of silicon oxide)
- IT Hydrocarbons, processes
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(fluoro, **polishing** pad; system, compn. and method of planarizing and **polishing** for preferential removal of silicon oxide)
- IT Group IIIA element compounds
RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(gallates, compn. for **polishing**; system, compn. and method of planarizing and **polishing** for preferential removal of silicon oxide)
- IT Polyamides, processes
Polycarbonates, processes
Polyesters, processes

- Polyethers, processes
 RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
 (polishing pad; system, compn. and method of planarizing and polishing for preferential removal of silicon oxide)
- IT Polyurethanes, processes
 RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
 (rheol. control agents; system, compn. and method of planarizing and polishing for preferential removal of silicon oxide)
- IT Composites
 Electric insulators
 (substrate; system, compn. and method of planarizing and polishing for preferential removal of silicon oxide)
- IT Polishing
 (system, compn. and method of planarizing and polishing for preferential removal of silicon oxide)
- IT 1306-38-3, Ceria, processes 1309-48-4, Magnesia, processes 1310-53-8, Germania, processes 1314-23-4, Zirconia, processes 1344-28-1, Alumina, processes 13463-67-7, Titania, processes
 RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
 (abrasives; system, compn. and method of planarizing and polishing for preferential removal of silicon oxide)
- IT 16984-48-8, Fluoride, processes
 RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
 (additives of compns.; system, compn. and method of planarizing and polishing for preferential removal of silicon oxide)
- IT 51-17-2, **Benzimidazole** 75-59-2, Tetramethylammonium hydroxide 77-92-9, Citric acid, processes 78-96-6, Isopropanolamine 87-66-1, Pyrogallol 87-69-4, Tartaric acid 88-99-3, Phthalic acid, processes 95-14-7, 1H-**Benzotriazole** 100-37-8, Diethylaminoethanol 108-01-0, Dimethylaminoethanol 109-83-1, Methylaminoethanol 126-44-3, Citrate, processes 141-43-5, Ethanolamine, processes 149-61-1, Malate 149-91-7, Gallic acid, processes 156-80-9, Malonate, processes 497-19-8, Sodium carbonate, processes 526-95-4, Gluconic acid 563-69-9, Carbonoperoxoic acid 608-59-3, Gluconate 1310-58-3, Potassium hydroxide, processes 1310-73-2, Sodium hydroxide, processes 1332-29-2, Tin oxide 1336-21-6, Ammonium hydroxide 1341-49-7, Ammonium hydrogen bifluoride 3179-63-3 3198-29-6, processes 6915-15-7, Malic acid 7005-47-2, 2-Dimethylamino-2-methyl-1-propanol 7601-90-3, Perchloric acid, processes 7664-38-2, Phosphoric acid, processes 7664-39-3, Hydrogen fluoride, processes 7782-68-5, Iodic acid 7789-23-3, Potassium fluoride 7789-29-9, Potassium fluoride (K(HF₂)) 12021-95-3 12125-01-8, Ammonium fluoride 12674-33-8, Perboric acid 13444-71-8, Periodic acid 13746-66-2, Potassium ferricyanide 15477-76-6, Phosphonate 15541-45-4, Bromate 16068-46-5, Potassium phosphate 16872-11-0 16961-83-4, Fluosilicic acid 17439-11-1, Fluorotitanic acid 19445-25-1, Perbromic acid 21351-79-1, Cesium hydroxide 37306-44-8, Triazole
 RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
 (compn. for polishing; system, compn. and method of planarizing and polishing for preferential removal of silicon oxide)
- IT 7631-86-9, Silica, processes
 RL: PEP (Physical, engineering or chemical process); PROC (Process)
 (fumed, Cabot's Semi-Sperse.COPYRGT. 25, Cab-O-Sperse SC-1; system, compn. and method of planarizing and polishing for preferential removal of silicon oxide)

IT 7429-90-5, Aluminum, processes 7439-88-5, Iridium, processes
 7440-06-4, Platinum, processes 7440-18-8, Ruthenium, processes
7440-25-7, Tantalum, processes 7440-32-6, Titanium,
 processes 7440-33-7, Tungsten, processes 7440-50-8, Copper, processes
 7440-57-5, Gold, processes
 RL: PEP (Physical, engineering or chemical process); PROC (Process)
 (metal substrate **polishing**; system, compn. and method of
 planarizing and **polishing** for preferential removal of silicon
 oxide)

IT 9002-86-2, Polyvinyl chloride 9002-88-4, **Polyethylene**
 9003-07-0, Polypropylene 9003-53-6, Polystyrene 24981-14-4, Polyvinyl
 fluoride
 RL: PEP (Physical, engineering or chemical process); TEM (Technical or
 engineered material use); PROC (Process); USES (Uses)
 (**polishing** pad; system, compn. and method of planarizing and
polishing for preferential removal of silicon oxide)

IT 10344-93-1, Acrylate, processes
 RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical
 process); PROC (Process); USES (Uses)
 (polymer, **polishing** pad, rheol. control agents, vinyl;
 system, compn. and method of planarizing and **polishing** for
 preferential removal of silicon oxide)

IT 409-21-2, Silicon carbide (SiC), processes 11104-08-8, Nickel phosphide
 11116-16-8, Titanium nitride 11130-73-7, Tungsten carbide 12033-62-4,
Tantalum nitride 37359-53-8, Tungsten nitride
 RL: PEP (Physical, engineering or chemical process); PROC (Process)
 (substrate **polishing**; system, compn. and method of
 planarizing and **polishing** for preferential removal of silicon
 oxide)

IT 622-93-5
 RL: MOA (Modifier or additive use); PEP (Physical, engineering or chemical
 process); PROC (Process); USES (Uses)
 (system, compn. and method of planarizing and **polishing** for
 preferential removal of silicon oxide)

IT 7732-18-5, Water, processes
 RL: PEP (Physical, engineering or chemical process); PROC (Process)
 (system, compn. and method of planarizing and **polishing** for
 preferential removal of silicon oxide)

IT **7440-25-7, Tantalum**, processes
 RL: PEP (Physical, engineering or chemical process); PROC (Process)
 (metal substrate **polishing**; system, compn. and method of
 planarizing and **polishing** for preferential removal of silicon
 oxide)

RN 7440-25-7 HCAPLUS
 CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

L36 ANSWER 2 OF 3 HCAPLUS COPYRIGHT 2001 ACS
 AN 2001:64307 HCAPLUS
 DN 134:124734
 TI Compositions and processes for spin etch planarization in semiconductor
 device fabrication
 IN Levert, Joseph; Towery, Daniel L.
 PA Alliedsignal Inc., USA
 SO PCT Int. Appl., 38 pp.
 CODEN: PIXXD2
 DT Patent

LA English
 IC ICM H01L021-321
 ICS C23F003-06
 CC 76-3 (Electric Phenomena)
 FAN.CNT 1

| | PATENT NO. | KIND | DATE | APPLICATION NO. | DATE |
|------|---|------|------------|-----------------|----------|
| PI | WO 2001006555 | A1 | 20010125 ✓ | WO 2000-US18723 | 20000710 |
| | W: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG | | | | |
| PRAI | US 1999-356487 | A | 19990719 | | |
| AB | The present invention describes methods and chem. compns. for the spin etch planarization of surfaces, particularly Cu and Ta. An etching soln. is brought into contact with the upper face of a spinning wafer through a nozzle, preferably an oscillating nozzle. The etching soln. has a compn. that oxidizes the spinning surface, forming a passivation layer thereon. The etching soln. further contains reactants for removing the passivation layer exposing the underlying surface to further reaction, leading to the desired etching of the surface. The characteristics of the etching soln. are adjusted such that reactant diffusion to lower regions of the surface limits the rate of etching. Faster reaction occurs at higher regions of the surface lying in more rapidly moving etching soln. resulting in the desired planarization. | | | | |
| ST | spin etching polishing semiconductor device fabrication; chem mech polishing device fabrication; oxidn etching device fabrication | | | | |
| IT | Alcohols, processes RL: NUU (Nonbiological use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses) (aliph.; in compns. and processes for spin etch planarization in semiconductor device fabrication) | | | | |
| IT | Surfactants (anionic; in compns. and processes for spin etch planarization in semiconductor device fabrication) | | | | |
| IT | Surfactants (cationic; in compns. and processes for spin etch planarization in semiconductor device fabrication) | | | | |
| IT | Polishing (chem.-mech.; compns. and processes for spin etch planarization in semiconductor device fabrication) | | | | |
| IT | Etching Integrated circuits Semiconductor device fabrication (compns. and processes for spin etch planarization in semiconductor device fabrication) | | | | |
| IT | Hydrocarbons, processes RL: NUU (Nonbiological use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses) (fluoro; in compns. and processes for spin etch planarization in semiconductor device fabrication) | | | | |
| IT | Nozzles (for spin etch planarization in semiconductor device fabrication) | | | | |
| IT | Oxidizing agents Wetting agents (in compns. and processes for spin etch planarization in semiconductor device fabrication) | | | | |

device fabrication)

IT Amines, processes
 Carboxylic acids, processes
 Gelatins, processes
 Phenols, processes
 RL: NUU (Nonbiological use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
 (in compns. and processes for spin etch planarization in semiconductor device fabrication)

IT Passivation
 (in spin etch planarization in semiconductor device fabrication).

IT Surfactants
 (nonionic; in compns. and processes for spin etch planarization in semiconductor device fabrication)

IT Surfactants
 (org.; in compns. and processes for spin etch planarization in semiconductor device fabrication)

IT Etching
 (photochem.; for planarization in semiconductor device fabrication)

IT Oxidation
 (surface; in spin etch planarization in semiconductor device fabrication)

IT **7440-25-7, Tantalum**, processes 7440-50-8, Copper, processes
 RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
 (compns. and processes for spin etch planarization of)

IT 57-55-6, Propyleneglycol, processes 60-00-4, EDTA, processes 62-76-0, Sodium oxalate 64-17-5, Ethanol, processes 64-19-7, Acetic acid, processes 67-56-1, Methanol, processes 68-04-2, Trisodium citrate 71-23-8, n-Propanol, processes 75-89-8 77-92-9, Citric acid, processes 87-69-4, Tartaric acid, processes 88-27-7, 2,6-Di-tert-butyl-4-[(dimethylamino)methyl]phenol 89-65-6, Erythorbic acid 95-14-7, 1H-**Benzotriazole** 102-71-6, Triethanolamine, processes 104-75-6, 2-Ethylhexylamine **107-21-1**, 1,2-Ethanediol, processes 128-37-0, Agidol, processes 139-33-3 144-62-7, Oxalic acid, processes 288-36-8, 1,2,3-Triazole **288-88-0**, 1H-1,2,4-Triazole 288-94-8, 1H-Tetrazole 1303-96-4, Borax 1310-73-2, Sodium hydroxide, processes 1333-39-7, Phenolsulfonic acid 1336-21-6, Ammonium hydroxide 6915-15-7, Malic acid 7439-98-7D, Molybdenum, salts, processes **7440-25-7D, Tantalum**, salts, processes 7440-50-8D, Copper, salts, processes 7447-40-7, Potassium chloride, processes 7631-95-0, Sodium molybdate 7631-99-4, Sodium nitrate, processes 7647-01-0, Hydrogen chloride, processes 7664-38-2, Phosphoric acid, processes 7664-39-3, Hydrogen fluoride, processes 7664-93-9, Sulfuric acid, processes 7697-37-2, Nitric acid, processes 7722-84-1, Hydrogen peroxide, processes 7733-02-0, Zinc sulfate 7758-89-6, Cuprous chloride 7758-98-7, Cupric sulfate, processes 7775-09-9, Sodium chlorate (NaClO3) 8061-51-6, Sodium lignosulfonate **9002-89-5, Polyvinyl alcohol 9002-92-0**, Poly(oxyethylene)lauryl ether 9004-32-4, Carboxymethylcellulose 12125-01-8, Ammonium fluoride 14066-19-4, Monohydrogen phosphate, processes 14265-44-2, Phosphate, processes 16887-00-6, Chloride, processes 17084-08-1, Hexafluorosilicate 26053-72-5, Diphenylsulfamic acid 27846-09-9, Iron monochloride 89800-24-8, Laprol 602
 RL: NUU (Nonbiological use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
 (in compns. and processes for spin etch planarization in semiconductor device fabrication)

RE.CNT 10

RE

- (1) Anon; PATENT ABSTRACTS OF JAPAN 1997, V1997(01)
- (2) Contolini; US 5486234 A 1996 HCAPLUS
- (3) Gelchinski; US 4497692 A 1985 HCAPLUS
- (4) Ibm; EP 0699782 A 1996 HCAPLUS
- (5) Kern; RCA REVIEW 1978, V39(2), P278 HCAPLUS
- (6) Samsung Electronics; DE 19928570 A 1999 HCAPLUS
- (7) Sasaki; US 5770095 A 1998 HCAPLUS
- (8) Sez Semiconductor-Equipment; EP 0905754 A 1999 HCAPLUS
- (9) Ube Ind Ltd; JP 08236615 A 1996 HCAPLUS
- (10) Unvala; JOURNAL OF THE ELECTROCHEMICAL SOCIETY 1972, V119(3), P318 HCAPLUS

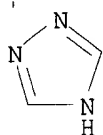
IT 7440-25-7, Tantalum, processes
 RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
 (comps. and processes for spin etch planarization of)
 RN 7440-25-7 HCAPLUS
 CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

IT 107-21-1, 1,2-Ethanediol, processes 288-88-0,
 1H-1,2,4-Triazole 7440-25-7D, Tantalum, salts,
 processes 9002-89-5, Polyvinyl alcohol
 9002-92-0, Poly(oxyethylene)lauryl ether
 RL: NUU (Nonbiological use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
 (in comps. and processes for spin etch planarization in semiconductor device fabrication)
 RN 107-21-1 HCAPLUS
 CN 1,2-Ethanediol (9CI) (CA INDEX NAME)

HO-CH₂-CH₂-OH

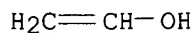
RN 288-88-0 HCAPLUS
 CN 1H-1,2,4-Triazole (7CI, 9CI) (CA INDEX NAME)



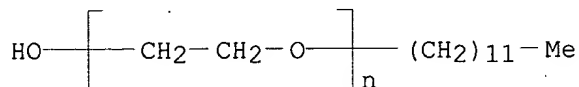
RN 7440-25-7 HCAPLUS
 CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta

RN 9002-89-5 HCAPLUS
 CN Ethenol, homopolymer (9CI) (CA INDEX NAME)
 CM 1
 CRN 557-75-5
 CMF C2 H4 O



RN 9002-92-0 HCAPLUS
 CN Poly(oxy-1,2-ethanediyl), .alpha.-dodecyl-.omega.-hydroxy- (9CI) (CA INDEX NAME)



- X L36 ANSWER 3 OF 3 HCAPLUS COPYRIGHT 2001 ACS
 AN 1989:218230 HCAPLUS
 DN 110:218230
 TI Air contaminants
 CS United States Occupational Safety and Health Administration, Washington, DC, 20210, USA
 SO Fed. Regist. (1989), 54(12, Bk. 2), 2332-983, 19 Jan 1989
 CODEN: FEREAC; ISSN: 0097-6326
 DT Journal
 LA English
 CC 59-5 (Air Pollution and Industrial Hygiene)
 Section cross-reference(s): 4
 AB Under the Federal Occupational Safety and Health act, OSHA is amending existing air containment stds. and setting new permissible exposure limits for toxic substances commonly used in the workplace.
 ST occupational exposure toxic chem std; safety toxic chem exposure std; dust occupational exposure std US; mist occupational exposure std US; fume occupational exposure std US
 IT Turpentine
 (air pollution by fumes of, occupational exposure to, stds. for, of USA)
 IT Gasoline
 Paraffin waxes and Hydrocarbon waxes, biological studies
 Petroleum spirits
 Stoddard solvent
 RL: ADV (Adverse effect, including toxicity); BIOL (Biological study)
 (air pollution by fumes of, occupational exposure to, stds. for, of USA)
 IT Petroleum
 RL: ADV (Adverse effect, including toxicity); BIOL (Biological study)
 (air pollution by mist of, occupational exposure to, stds. for, of USA)
 IT Carbon black, biological studies
 Cyanides, biological studies
 Pyrethrins and Pyrethroids
 RL: ADV (Adverse effect, including toxicity); POL (Pollutant); BIOL (Biological study); OCCU (Occurrence)
 (air pollution by, occupational exposure to, stds. for, in USA)
 IT Particles
 Sawdust
 (air pollution by, occupational exposure to, stds. for, of USA)
 IT Fluorides, biological studies
 Petroleum gases, liquefied
 RL: POL (Pollutant); OCCU (Occurrence)
 (air pollution by, occupational exposure to, stds. for, of USA)
 IT Air pollution

(by toxic dusts and fumes and gases, occupational exposure to, stds. for, of USA)

IT **Polishing**
(dust from, air pollution by, occupational exposure to, stds. for, of USA)

IT **Wood**
(dust of, air pollution by, occupational exposure to, stds. for, of USA)

IT **Borates**
Kaolin, biological studies
Kieselguhr
Limestone, biological studies
Marble
Mica-group minerals, biological studies
Perlite
Silicates, biological studies
Soapstone
RL: ADV (Adverse effect, including toxicity); POL (Pollutant); BIOL (Biological study); OCCU (Occurrence)
(dust of, air pollution by, occupational exposure to, stds. for, of USA)

IT **Standards, legal and permissive**
(for airborne toxic substance occupational exposure, of USA)

IT **Pitch**
(coal-tar, air pollution by, occupational exposure to, stds. for, of USA)

IT **Dust**
(cotton, air pollution by, occupational exposure to, stds. for, of USA)

IT **Coal**
RL: POL (Pollutant); OCCU (Occurrence)
(dust, air pollution by, occupational exposure to, stds. for, of USA)

IT **Welding**
(fumes, air pollution by, occupational exposure to, stds. for, of USA)

IT **Dust**
(grain, air pollution by, occupational exposure to, stds. for, of USA)

IT **Asbestos**
RL: ADV (Adverse effect, including toxicity); POL (Pollutant); BIOL (Biological study); OCCU (Occurrence)
(grunerite, dust of, air pollution by, occupational exposure to, stds. for, of USA)

IT **Hygiene**
(industrial, airborne toxic substance exposure stds. in relation to, of USA)

IT **Cement**
(portland, dust of, air pollution by, occupational exposure to, stds. for, of USA)

IT **Oils, glyceridic**
RL: ADV (Adverse effect, including toxicity); BIOL (Biological study)
(vegetable, air pollution by mist of, occupational exposure to, stds. for, of USA)

IT **Fumes**
(welding, air pollution by, occupational exposure to, stds. for, of USA)

IT **463-49-0, Propadiene**
RL: ADV (Adverse effect, including toxicity); BIOL (Biological study)
(air pollution by methylacetylene and, occupational exposure to, stds. for, of USA)

IT **50-00-0, Formaldehyde, biological studies** 50-29-3, biological studies
50-32-8, Benzo[a]pyrene, biological studies 50-78-2 53-96-3 54-11-5,
Nicotine 55-38-9, Fenthion 55-63-0, Nitroglycerin 56-23-5,
biological studies 56-38-2, Parathion 56-81-5,

1,2,3-Propanetriol, biological studies 57-14-7, 1,1-Dimethylhydrazine
 57-24-9, Strychnine 57-50-1, biological studies 57-57-8, 2-Oxetanone
 58-89-9, Lindane 60-11-7, 4-Dimethylaminoazobenzene 60-29-7, Ethyl
 ether, biological studies 60-34-4, Methyl hydrazine 60-57-1, Dieldrin
 61-82-5, Amitrole 62-53-3, Aniline, biological studies
 62-73-7, Dichlorvos 62-74-8, Sodium fluoroacetate 62-75-9,
 N-Nitrosodimethylamine 63-25-2 64-17-5, Ethyl alcohol, biological
 studies 64-18-6, Formic acid, biological studies 64-19-7, Acetic acid,
 biological studies 67-56-1, Methyl alcohol, biological studies
 67-63-0, Isopropyl alcohol, biological studies 67-64-1, Acetone,
 biological studies 67-66-3, Chloroform, biological studies 67-72-1,
 Hexachloroethane 68-11-1, Thioglycolic acid, biological studies
 68-12-2, Dimethylformamide, biological studies 71-23-8, n-Propyl
 alcohol, biological studies 71-36-3, n-Butyl alcohol, biological studies
 71-43-2, Benzene, biological studies 71-55-6, Methyl chloroform
 72-20-8, Endrin 72-43-5, Methoxychlor 74-83-9, Methyl bromide,
 biological studies 74-87-3, Methyl chloride, biological studies
 74-88-4, biological studies 74-89-5, Methylamine, biological studies
 74-90-8, Hydrogen cyanide, biological studies 74-93-1, Methyl mercaptan,
 biological studies 74-96-4, Ethyl bromide 74-97-5, Chlorobromomethane
 74-98-6, Propane, biological studies 74-99-7, Methyl acetylene
 75-00-3, Ethyl chloride 75-01-4, biological studies 75-04-7,
 Ethylamine, biological studies 75-05-8, Acetonitrile, biological studies
 75-07-0, Acetaldehyde, biological studies 75-08-1, Ethyl mercaptan
 75-09-2, Methylene chloride, biological studies 75-12-7, Formamide,
 biological studies 75-15-0, Carbon disulfide, biological studies
 75-21-8, Oxirane, biological studies 75-25-2, Bromoform 75-31-0,
 Isopropylamine, biological studies 75-34-3, 1,1-Dichloroethane
 75-35-4, Vinylidene chloride, biological studies 75-43-4,
 Dichloromonofluoromethane 75-44-5, Phosgene 75-45-6,
 Chlorodifluoromethane 75-47-8, Iodoform 75-50-3, Trimethylamine,
 biological studies 75-52-5, Nitromethane, biological studies 75-55-8
 75-56-9, biological studies 75-61-6, Difluorodibromomethane 75-63-8,
 Trifluorobromomethane 75-65-0, tert-Butyl alcohol, biological studies
 75-69-4, Fluorotrichloromethane 75-71-8, Dichlorodifluoromethane
 75-74-1, Tetramethyl lead 75-99-0, 2,2-Dichloropropionic acid 76-03-9,
 Trichloroacetic acid, biological studies 76-06-2, Chloropicrin
 76-11-9, 1,1,1,2-Tetrachloro-2,2-difluoroethane 76-12-0,
 1,1,2,2-Tetrachloro-1,2-difluoroethane 76-13-1, 1,1,2-Trichloro-1,2,2-
 trifluoroethane 76-15-3, Chloropentafluoroethane 76-22-2, Camphor
 76-44-8 77-47-4, Hexachlorocyclopentadiene 77-73-6, Dicyclopentadiene
 77-78-1, Dimethyl sulfate 78-00-2, Tetraethyl lead 78-30-8 78-34-2,
 Dioxathion 78-59-1, Isophorone 78-83-1, Isobutyl alcohol, biological
 studies 78-87-5, Propylene dichloride 78-92-2, sec-Butyl alcohol
 78-93-3, 2-Butanone, biological studies 79-00-5, 1,1,2-Trichloroethane
 79-01-6, biological studies 79-04-9, Chloroacetyl chloride 79-06-1,
 2-Propenamide, biological studies 79-09-4, Propionic acid, biological
 studies 79-10-7, 2-Propenoic acid, biological studies 79-20-9, Methyl
 acetate 79-24-3, Nitroethane 79-27-6, Acetylene tetrabromide
 79-34-5, 1,1,2,2,-Tetrachloroethane 79-41-4, biological studies
 79-46-9, 2-Nitropropane 80-62-6 81-81-2, Warfarin 83-26-1, Pindone
 83-79-4, Rotenone 84-66-2, Diethyl phthalate 84-74-2, Dibutyl
 phthalate 85-00-7 85-44-9, Phthalic anhydride 86-50-0,
 Azinphos-methyl 87-68-3, Hexachlorobutadiene 87-86-5,
 Pentachlorophenol 88-72-2, o-Nitrotoluene 88-89-1, Picric acid
 89-72-5, o-sec-Butylphenol 90-04-0, o-Anisidine 91-20-3, Naphthalene,
 biological studies 91-59-8, .beta.-Naphthylamine 91-94-1,
 3,3'-Dichlorobenzidine 92-52-4, Diphenyl, biological studies 92-67-1,
 4-Aminodiphenyl 92-84-2, Phenothiazine 92-87-5, Benzidine 92-93-3,
 4-Nitrodiphenyl 93-76-5 94-36-0, Benzoyl peroxide, biological studies
 94-75-7, biological studies 95-13-6, Indene 95-47-6, biological

studies 95-48-7, 2-Methyl phenol, biological studies 95-49-8,
 o-Chlorotoluene 95-50-1, o-Dichlorobenzene 95-53-4, o-Toluidine,
 biological studies 96-12-8, 1,2-Dibromo-3-chloropropane 96-18-4,
 1,2,3-Trichloropropane 96-22-0, Diethyl ketone 96-33-3 96-69-5,
 4,4'-Thiobis(6-tert-butyl-m-cresol) 97-77-8, Disulfiram 98-00-0,
 Furfuryl alcohol 98-01-1, Furfural, biological studies 98-51-1,
 p-tert-Butyltoluene 98-82-8, Cumene 98-83-9, biological studies
 98-95-3, Nitrobenzene, biological studies 99-08-1, m-Nitrotoluene
 99-65-0, 1,3-Dinitrobenzene 99-99-0, p-Nitrotoluene 100-00-5,
 p-Nitrochlorobenzene 100-01-6, biological studies 100-25-4 100-37-8
 100-41-4, Ethyl benzene, biological studies 100-42-5, biological studies
 100-44-7, Benzyl chloride, biological studies 100-61-8, biological
 studies 100-63-0 100-74-3, N-Ethylmorpholine 101-14-4,
 4,4'-Methylene bis(2-chloroaniline) 101-68-8 101-84-8, Phenyl ether
 102-54-5, Dicyclopentadienyl iron 102-81-8 104-94-9, p-Anisidine
 105-46-4, sec-Butyl acetate 105-60-2, biological studies 106-35-4,
 3-Heptanone 106-42-3, p-Xylene, biological studies 106-44-5,
 4-Methylphenol, biological studies 106-46-7, p-Dichlorobenzene
 106-49-0, p-Toluidine, biological studies 106-50-3, p-Phenylene diamine,
 biological studies 106-51-4, 2,5-Cyclohexadiene-1,4-dione, biological
 studies 106-68-3, Ethyl amyl ketone 106-87-6 106-89-8,
 Epichlorohydrin, biological studies 106-92-3, Allyl glycidyl ether
 106-93-4, Ethylene dibromide 106-97-8, Butane, biological studies
 106-99-0, 1,3-Butadiene, biological studies 107-02-8, Acrolein,
 biological studies 107-05-1, Allyl chloride 107-06-2, Ethylene
 dichloride, biological studies 107-07-3, Ethylene chlorohydrin,
 biological studies 107-13-1, Acrylonitrile, biological studies
 107-15-3, 1,2-Ethanediamine, biological studies 107-18-6, Allyl alcohol,
 biological studies 107-19-7, Propargyl alcohol 107-20-0,
 Chloroacetaldehyde 107-21-1, 1,2-Ethanediol, biological studies
 107-30-2, Chloromethyl methyl ether 107-31-3, Methyl formate 107-41-5,
 Hexylene glycol 107-49-3, TEPP 107-66-4, Dibutyl phosphate 107-87-9,
 2-Pentanone 108-03-2, 1-Nitropropane 108-05-4, **Vinyl**
acetate, biological studies 108-10-1, Hexone 108-11-2, Methyl
 isobutyl carbinol 108-18-9, Diisopropylamine 108-20-3, Isopropyl ether
 108-21-4, Isopropyl acetate 108-24-7, Acetic anhydride 108-31-6,
 2,5-Furandione, biological studies 108-38-3, m-Xylene, biological
 studies 108-39-4, 3-Methylphenol, biological studies 108-44-1,
 m-Toluidine, biological studies 108-46-3, Resorcinol, biological studies
 108-83-8, Diisobutyl ketone 108-84-9 108-87-2, Methylcyclohexane
 108-88-3, biological studies 108-90-7, Chlorobenzene, biological studies
 108-91-8, Cyclohexanamine, biological studies 108-93-0, Cyclohexanol,
 biological studies 108-94-1, Cyclohexanone, biological studies
 108-95-2, Phenol, biological studies 108-98-5, Phenyl mercaptan,
 biological studies 109-59-1, 2-Isopropoxyethanol 109-60-4, n-Propyl
 acetate 109-66-0, Pentane, biological studies 109-73-9, Butylamine,
 biological studies 109-79-5, Butyl mercaptan 109-86-4, Methyl
 cellosolve 109-87-5, Methylal
 RL: ADV (Adverse effect, including toxicity); POL (Pollutant); BIOL
 (Biological study); OCCU (Occurrence)
 (air pollution by, occupational exposure to, stds. for, in USA)
 IT 109-89-7, Diethylamine, biological studies 109-94-4, Ethyl formate
 109-99-9, Tetrahydrofuran, biological studies 110-12-3, Methyl isoamyl
 ketone 110-19-0, Isobutyl acetate 110-43-0, Methyl-n-amyl ketone
 110-49-6 110-54-3, n-Hexane, biological studies 110-62-3,
 n-Valeraldehyde 110-80-5, 2-Ethoxyethanol 110-82-7, Cyclohexane,
 biological studies 110-83-8, Cyclohexene, biological studies 110-86-1,
 Pyridine, biological studies 110-91-8, Morpholine, biological studies
 111-15-9, 2-Ethoxyethyl acetate 111-30-8, Pentanedial 111-40-0
 111-42-2, Diethanolamine, biological studies 111-44-4 111-65-9,
 Octane, biological studies 111-76-2, 2-Butoxyethanol 111-84-2, Nonane

114-26-1, Propoxur 115-29-7, Endosulfan 115-77-5, Pentaerythritol,
 biological studies 115-86-6, Triphenyl phosphate 115-90-2,
 Fensulfothion 117-81-7 118-52-5, 1,3-Dichloro-5,5-dimethyl hydantoin
 118-96-7, 2,4,6-Trinitrotoluene 120-80-9, Catechol, biological studies
 120-82-1, 1,2,4-Trichlorobenzene 121-44-8, Triethylamine, biological
 studies 121-45-9, Trimethyl phosphite 121-69-7, biological studies
 121-75-5, Malathion 121-82-4, Cyclonite 122-39-4, Diphenylamine,
 biological studies 122-60-1, Phenyl glycidyl ether 123-19-3, Dipropyl
 ketone 123-31-9, 1,4-Benzenediol, biological studies 123-42-2,
 Diacetone alcohol 123-51-3, Isoamyl alcohol 123-73-9 123-86-4,
 n-Butyl-acetate 123-91-1, 1,4-Dioxane, biological studies 123-92-2,
 Isoamyl acetate 124-38-9, Carbon dioxide, biological studies 124-40-3,
 Dimethylamine, biological studies 126-73-8, Tributyl phosphate,
 biological studies 126-98-7, Methylacrylonitrile 126-99-8,
 .beta.-Chloroprene 127-18-4, Perchloroethylene, biological studies
 127-19-5 128-37-0, 2,6-Di-tert-butyl-p-cresol, biological studies
 131-11-3, Dimethylphthalate 133-06-2, Captan 134-32-7,
 1-Naphthalenamine 136-78-7, Sesone 137-05-3, Methyl 2-cyanoacrylate
 137-26-8, Thiram 138-22-7, n-Butyl lactate 140-88-5 141-32-2
 141-43-5, biological studies 141-66-2, Dicrotophos 141-78-6, Ethyl
 acetate, biological studies 141-79-7, Mesityl oxide 142-64-3,
 Piperazine dihydrochloride 142-82-5, Heptane, biological studies
 144-62-7, Ethanedioic acid, biological studies 148-01-6 150-76-5,
 4-Methoxyphenol 151-56-4, Aziridine, biological studies 156-62-7,
 Calcium cyanamide 218-01-9, Chrysene 287-92-3, Cyclopentane
 298-00-0, Methyl parathion 298-02-2, Phorate 298-04-4, Disulfoton
 299-84-3, Ronnel 299-86-5, Crufomate 300-76-5, Dimethyl-1,2-dibromo-
 2,2-dichloroethyl phosphate 302-01-2, Hydrazine, biological studies
 309-00-2, Aldrin 314-40-9, Bromacil 330-54-1, Diuron 333-41-5,
 Diazinon 334-88-3, Diazomethane 353-50-4, Carbonyl fluoride
 409-21-2, Silicon carbide, biological studies 420-04-2, Cyanamide
 463-51-4, Ketene 471-34-1, Carbonic acid calcium salt (1:1), biological
 studies 479-45-8, Tetryl 504-29-0, 2-Aminopyridine 506-77-4,
 Cyanogen chloride 509-14-8, Tetranitromethane 528-29-0,
 1,2-Dinitrobenzene 532-27-4 534-52-1, Dinitro-o-cresol 540-59-0,
 1,2-Dichloroethylene 540-88-5, tert-Butyl acetate 542-75-6,
 1,3-Dichloropropene 542-88-1, Bis(Chloromethyl) ether 542-92-7,
 Cyclopentadiene, biological studies 552-30-7 556-52-5, Glycidol
 557-05-1, Zinc stearate 558-13-4, Carbon tetrabromide 563-12-2, Ethion
 563-80-4, Methyl isopropyl ketone 583-60-8 584-84-9 591-78-6,
 2-Hexanone 593-60-2, Vinyl bromide 594-42-3, Perchloromethyl mercaptan
 594-72-9, 1,1-Dichloro-1-nitroethane 600-25-9, 1-Chloro-1-nitropropane
 603-34-9, Triphenyl amine 624-83-9, Methyl isocyanate 626-17-5,
 1,3-Benzenedicarbonitrile 627-13-4, n-Propyl nitrate 628-63-7, n-Amyl
 acetate 628-96-6, **Ethylene glycol** dinitrate
 630-08-0, Carbon monoxide, biological studies 638-21-1, Phenylphosphine
 681-84-5, Methyl silicate 684-16-2, Hexafluoroacetone 768-52-5,
 N-Isopropylaniline 944-22-9, Fonofos 999-61-1, 2-Hydroxypropyl
 acrylate 1189-85-1, tert-Butyl chromate 1300-73-8, Xylidine
 1303-96-4, Borax decahydrate 1305-62-0, Calcium hydroxide, biological
 studies 1305-78-8, Calcium oxide, biological studies 1309-37-1, Iron
 oxide, biological studies 1309-48-4, Magnesium oxide, biological studies
 1310-58-3, Potassium hydroxide, biological studies 1310-73-2, Sodium
 hydroxide, biological studies 1314-13-2, Zinc oxide, biological studies
 1314-62-1, Vanadium pentoxide, biological studies 1314-80-3, Phosphorus
 pentasulfide 1319-77-3, Cresol 1320-37-2, Dichlorotetrafluoroethane
 1320-67-8, Propylene glycol monomethyl ether 1321-64-8,
 Pentachloronaphthalene 1321-65-9, Trichloronaphthalene 1321-74-0,
 Divinyl benzene, biological studies 1330-43-4, Anhydrous borax
 1332-29-2, Tin oxide 1335-87-1, Hexachloronaphthalene 1335-88-2,
 Tetrachloronaphthalene 1344-28-1, .alpha.-Alumina, biological studies

1344-95-2, Calcium silicate 1477-55-0, 1,3-Benzenedimethanamine
 1563-66-2, Carbofuran 1912-24-9 1929-82-4, 2-Chloro-6-trichloromethyl
 pyridine 2039-87-4, o-Chlorostyrene 2074-87-5, Cyanogen 2104-64-5
 2179-59-1, Allyl propyl disulfide 2234-13-1, Octachloronaphthalene
 2238-07-5, Diglycidyl ether 2425-06-1, Captafol 2426-08-6 2551-62-4,
 Sulfur hexafluoride 2698-41-1, o-Chlorobenzylidene malononitrile
 2699-79-8, Sulfuryl fluoride 2921-88-2, Chlorpyrifos 2971-90-6,
 Clopidol 3333-52-6, Tetramethyl succinonitrile 3383-96-8, Temephos
 3394-04-5 3689-24-5, Sulfotep 4016-14-2, Isopropyl glycidyl ether
 4098-71-9, Isophorone diisocyanate 4170-30-3, Crotonaldehyde 4685-14-7
 5124-30-1 6423-43-4, Propylene glycol dinitrate 6923-22-4,
 Monocrotophos 7429-90-5, Aluminum, biological studies 7429-90-5D,
 Aluminum, compds. 7439-89-6, Iron, biological studies 7439-89-6D,
 Iron, salts 7439-92-1, Lead, biological studies 7439-96-5, Manganese,
 biological studies 7439-96-5D, Manganese, compds. 7439-97-6, Mercury,
 biological studies 7439-97-6D, Mercury, compds. 7439-98-7, Molybdenum,
 biological studies 7439-98-7D, Molybdenum, compds. 7440-02-0, Nickel,
 biological studies 7440-02-0D, Nickel, compds. 7440-06-4, Platinum,
 biological studies 7440-06-4D, Platinum, salts 7440-16-6, Rhodium,
 biological studies 7440-16-6D, Rhodium, compds. 7440-21-3, Silicon,
 biological studies 7440-22-4, Silver, biological studies
7440-25-7, Tantalum, biological studies 7440-28-0D,
 Thallium, compds. 7440-31-5, Tin, biological studies 7440-31-5D, Tin,
 compds. 7440-33-7, Tungsten, biological studies 7440-33-7D, Tungsten,
 compds. 7440-36-0, Antimony, biological studies 7440-38-2D, Arsenic,
 inorg. and org. compds. 7440-39-3D, Barium, compds. 7440-41-7,
 Beryllium, biological studies 7440-41-7D, Beryllium, compds.
 7440-43-9, Cadmium, biological studies 7440-47-3, Chromium, biological
 studies 7440-47-3D, Chromium, compds. 7440-48-4, Cobalt, biological
 studies 7440-50-8, Copper, biological studies 7440-58-6, Hafnium,
 biological studies 7440-61-1, Uranium, biological studies 7440-61-1D,
 Uranium, compds. 7440-62-2, Vanadium, biological studies 7440-65-5,
 Yttrium, biological studies 7440-67-7D, Zirconium, compds. 7440-74-6,
 Indium, biological studies 7440-74-6D, Indium, compds. 7446-09-5,
 Sulfur dioxide, biological studies 7553-56-2, Iodine, biological studies
 7572-29-4, Dichloroacetylene 7580-67-8, Lithium hydride 7616-94-6,
 Perchloryl fluoride 7631-86-9, Silica, biological studies 7631-90-5,
 Sodium bisulfite 7637-07-2, Boron trifluoride, biological studies
 7646-85-7, Zinc chloride, biological studies 7647-01-0, Hydrogen
 chloride, biological studies
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 IT 7664-38-2, Phosphoric acid, biological studies 7664-39-3, Hydrogen
 fluoride, biological studies 7664-41-7, Ammonia, biological studies
 7664-93-9, Sulfuric acid, biological studies 7681-57-4, Sodium
 metabisulfite 7697-37-2, Nitric acid, biological studies 7719-09-7,
 Thionyl chloride 7719-12-2, Phosphorus trichloride 7722-84-1, Hydrogen
 peroxide, biological studies 7722-88-5, Tetrasodium pyrophosphate
 7723-14-0, Phosphorus, biological studies 7726-95-6, Bromine, biological
 studies 7727-43-7, Barium sulfate 7738-94-5, Chromic acid (H₂CrO₄)
 7773-06-0, Ammonium sulfamate 7778-18-9, Calcium sulfate 7782-41-4,
 Fluorine, biological studies 7782-42-5, Graphite, biological studies
 7782-49-2D, Selenium, compds. 7782-50-5, Chlorine, biological studies
 7782-65-2, Germanium tetrahydride 7783-06-4, Hydrogen sulfide,
 biological studies 7783-07-5, Hydrogen selenide 7783-41-7, Oxygen
 difluoride 7783-54-2, Nitrogen trifluoride 7783-60-0, Sulfur
 tetrafluoride 7783-79-1, Selenium hexafluoride 7783-80-4, Tellurium
 hexafluoride 7784-42-1, Arsine 7786-34-7, Phosdrin 7789-30-2,
 Bromine pentafluoride 7790-91-2, Chlorine trifluoride 7803-51-2,
 Phosphine 7803-52-3, Stibine 7803-62-5, Silicon tetrahydride,

biological studies 8001-35-2, Chlorinated camphene 8022-00-2, Methyl demeton 8065-48-3 9001-92-7, Proteinase 9004-34-6, Cellulose, biological studies 10025-67-9, Sulfur monochloride 10025-87-3, Phosphorus oxychloride 10026-13-8, Phosphorus pentachloride 10028-15-6, Ozone, biological studies 10035-10-6, Hydrogen bromide, biological studies 10049-04-4, Chlorine dioxide 10102-43-9, Nitric oxide, biological studies 10102-44-0, Nitrogen dioxide, biological studies 10210-68-1 10294-33-4, Boron tribromide 10546-01-7, Sulfur pentafluoride 11097-69-1, Aroclor 1254 11099-06-2, Ethyl silicate 12079-65-1, Manganese cyclopentadienyl tricarbonyl 12108-13-3, Methylcyclopentadienyl manganese tricarbonyl 12125-02-9, Ammonium chloride, biological studies 12179-04-3, Sodium tetraborate pentahydrate 12415-34-8, Emery 12604-58-9 12789-03-6, Chlordane 13121-70-5, Cyhexatin 13397-24-5, Gypsum, biological studies 13463-39-3, Nickel carbonyl 13463-40-6 13463-67-7, Titanium dioxide, biological studies 13494-80-9, Tellurium, biological studies 13494-80-9D, Tellurium, compds. 13530-65-9, Zinc chromate 13717-00-5, Magnesite 14464-46-1, Cristobalite 14484-64-1, Ferbam 14808-60-7, Quartz, biological studies 15468-32-3, Tridymite 16219-75-3 16752-77-5, Methomyl 16842-03-8, Cobalt hydrocarbonyl 17702-41-9, Decaborane 17804-35-2, Benomyl 19287-45-7, Diborane 19624-22-7, Pentaborane 20816-12-0 21087-64-9 21351-79-1, Cesium hydroxide (Cs(OH)) 22224-92-6, Fenamiphos 25013-15-4 25321-14-6, Dinitrotoluene 25551-13-7, Trimethyl benzene 25639-42-3, Methylcyclohexanol 26140-60-3, Terphenyl 26140-60-3D, Terphenyl, hydrogenated derivs. 26499-65-0, Plaster of Paris 26628-22-8, Sodium azide 26952-21-6, Isooctyl alcohol 27323-18-8, Chlorodiphenyl 31242-93-0 34590-94-8 35400-43-2 37293-14-4, Bismuth telluride 53496-15-4, sec-Amyl acetate 54566-73-3, Boron oxide 92414-44-3, Manganese tetroxide

RL: ADV (Adverse effect, including toxicity); POL (Pollutant); BIOL (Biological study); OCCU (Occurrence)

(air pollution by, occupational exposure to, stds. for, in USA)

IT 14807-96-6, Talc, biological studies 60676-86-0

RL: POL (Pollutant); OCCU (Occurrence)

(air pollution by, occupational exposure to, stds. for, of US)

IT 14567-73-8, Tremolite

RL: ADV (Adverse effect, including toxicity); POL (Pollutant); BIOL (Biological study); OCCU (Occurrence)

(asbestiform, air pollution by, occupational exposure to, stds. for, of US)

IT 56-81-5, 1,2,3-Propanetriol, biological studies 61-82-5,

Amitrole 107-21-1, 1,2-Ethanediol, biological studies

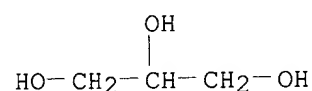
7440-25-7, Tantalum, biological studies

RL: ADV (Adverse effect, including toxicity); POL (Pollutant); BIOL (Biological study); OCCU (Occurrence)

(air pollution by, occupational exposure to, stds. for, in USA)

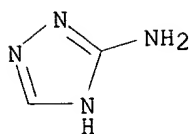
RN 56-81-5 HCAPLUS

CN 1,2,3-Propanetriol (9CI) (CA INDEX NAME)



RN 61-82-5 HCAPLUS

CN 1H-1,2,4-Triazol-3-amine (9CI) (CA INDEX NAME)



RN 107-21-1 HCAPLUS
CN 1,2-Ethanediol (9CI) (CA INDEX NAME)

HO-CH₂-CH₂-OH

RN 7440-25-7 HCAPLUS
CN Tantalum (8CI, 9CI) (CA INDEX NAME)

Ta .

4 22862 SEA FILE=WPIX 1,2,4-TRIAZOLE OR BENZOTRIAZOLE OR IMIDAZOLE OR
5-METHYLBENZIMIDAZOLE OR POLYANILINE OR INDAZOLE OR PURINE OR
BTA
L5 22270 SEA FILE=WPIX PVA OR PAA OR GEO OR GPO OR DCA OR PEI OR
DMSIO-EO
L6 269703 SEA FILE=WPIX POLYVINYL ALCOHOL OR VINYL ACETATE OR POLYETHYLEN
E OR SORBITOL OR GLYCEROL OR POLYACRYLAMIDE OR ETHYLENE GLYCOL
OR GLYCEROL ETHOXYLATE OR DIMETHYLSILOXANE ETHYLENE OXIDE OR
POLYETHYLENE OXIDE OR POLYOXYETHYLENE OR GLYCEROL PROPOXYLATE
OR ?HEXYLAMINE OR POLYETHYLENEIMINE
L7 1879 SEA FILE=WPIX L4 AND (L5 OR L6)
L9 29624 SEA FILE=WPIX TA OR TANTALUM
L10 16 SEA FILE=WPIX L9 AND L7
L12 3 SEA FILE=WPIX (CMP OR POLISH?) AND L10

=> d max 1-

YOU HAVE REQUESTED DATA FROM 3 ANSWERS - CONTINUE? Y/(N):y

L12 ANSWER 1 OF 3 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD
AN 2001-495784 [54] WPIX
CR 2001-637758 [47]
DNN N2001-367323 DNC C2001-148826
TI Process for chemical-mechanical planarization of copper containing
semiconductor wafer involves subjecting the wafer in aqueous primary
and/or secondary slurry containing diamond particles.
DC A85 E19 L03 U11
IN BUCKLEY, D J; CERUTTI, D B; HORKAY, F; KELEHER, J J; LI, Y; TYRE, E R;
URIARTE, R J
PA (GENE) GENERAL ELECTRIC CO
CYC 1
PI US 6242351 B1 20010605 (200154)* 8p H01L021-302
ADT US 6242351 B1 CIP of US 1999-472104 19991227, US 2000-591189 20000608
PRAI US 2000-591189 20000608; US 1999-472104 19991227
IC ICM H01L021-302
ICS H01L021-461
AB US 6242351 B UPAB: 20011211
NOVELTY - A multistage process for the chemical-mechanical planarization
(CPM) of a semiconductor wafer involves subjecting the wafer to CPM using
aqueous primary and secondary slurries containing diamond particles having
an average particle size of at most 0.4 micrometer.
DETAILED DESCRIPTION - A multistage process for the
chemical-mechanical planarization (CPM) of a semiconductor wafer involves:
(i) subjecting a semiconductor wafer to CPM using a primary slurry
containing (wt.%) an oxidizer (0 - 5), at least one of a complexing agent
or a passivating agent (0 - 7), a surfactant (0 - 5), diamond particles
(0.001 - 5) and a pH adjustment agent to maintain the pH of 3 - 10;
(ii) cleaning the wafer of step (i);
(iii) subjecting the cleaned wafer to CPM using a secondary aqueous
slurry containing (wt.%) a complexing agent (0 - 7), a surfactant (0 - 5),
diamond particles (0.001 - 5) and a pH adjustment agent to maintain the pH
of 4 - 10; and
(iv) cleaning the wafer of step (iii).
The diamond particles in the primary and secondary slurry have an
average particle size of at most 0.4 micro m.
INDEPENDENT CLAIMS are also included for the following:
(A) a single-stage process for CPM of a semiconductor wafer involving
subjecting the wafer to CPM using the secondary slurry; and
(B) an improved aqueous slurry containing a Cu complexing agent and
hydrogen peroxide for CPM.
The aqueous slurry also contains a hydroxyl radical quenching agent

to reduce Cu corrosion.

USE - In the chemical-mechanical planarization of Cu-containing semiconductor wafers (claimed).

ADVANTAGE - The use of the primary diamond slurry in the first stage enables better selectivity for removal of copper relative to Ta than using conventional alumina or silica slurries. Low concentration diamond slurries expect lower disposal costs. At the very low concentrations of diamond employed, there is little diamond consumed by the CMP operation and keeping such low concentration of diamond dispersed is a simpler operation. Use of secondary diamond slurry reduces erosion as compared to conventional silica slurries and the slurry also translates into greater Ta/oxide selectivity i.e. maximum

Ta polishing rate with minimum oxide **polishing**

rate than is seen with conventional silica slurries. During process, the slurries maintain good material removed rates of Cu, low scratch density and a low level of corrosion compared to conventional **polishing** slurries.

Dwg.0/0

TECH US 6242351 B1 UPTX: 20010924

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Slurry: The primary slurry comprises (wt%) the complexing or passivating agent (1 - 5). The surfactant in the primary and secondary slurry is present in an amount of 0.1 - 1 wt.%. The diamond particles in the primary and secondary slurry are present in an amount of 0.025 - 0.5 (preferably 0.01 - 0.1) wt.%. The primary slurry also comprises a hydroxyl radical quenching agent. Preferred Components: The complexing agent is at least one of diamine, triamine, alkyl or aryl dicarboxylic acid or amino acid. The passivating agent is **benzotriazole** or a substituted triazole. The surfactant is alkyl or aryl carboxylic acid, sulfate or ammonium salt. The diamond particles comprise polycrystalline diamond particles. The pH adjustment agent is an acid selected from at least one of mineral acid, organic acid or a base such as an organic amine. The hydroxyl radical quenching agent is at least one of an iodide compound, carbonate compound, 2-propanol, glycol compound, 1,3-cyclohexadiene compound, glycerin or **glycerol** compound, tin hydride compound, humic acid, an azobenzene compound or an unsaturated amine. The Cu complexing agent comprises glycine.

TECHNOLOGY FOCUS - POLYMERS - Preferred Compounds: The surfactant is at least one of an alkylated **polyethylene oxide**, alkylated cellulose or an alkylated **polyvinyl alcohol**.

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Components: The semiconductor wafer includes Cu. The pH adjustment agent is alkali or alkaline earth metal hydroxides and oxides or ammonia.

ABEX US 6242351 B1 UPTX: 20010924

EXAMPLE - An aqueous surfactant solution was prepared by adding Arlasolve 200L (RTM; surfactant) to deionized water followed by agitation for 10 minutes or until no surfactant was visible in the solution. The solution was then subjected to sonication for 25 minutes. Monocrystalline diamond was prepared and graded to obtain micronized diamond particles having an average particle size of 0.15 micron with a maximum particle of 1 micron. This diamond was dispersed in deionized water containing various amounts of Arlasolve 200L with the assistance of sonication to obtain a slurry having a concentration of monocrystalline diamond (0.1 wt.%) and the surfactant (0.1 wt.%). The slurry was then stirred for 10 minutes. Sonication was applied for an additional 25 minutes. Then slurry was again stirred for 2 minutes and hydrogen peroxide (1 wt.%) and glycine (1 wt.%) were added into the slurry. Finally, the pH of the slurry was adjusted using dilute KOH at 5 - 6. A comparative slurry was prepared using conventional alumina particles. A test substrate of silicon wafer on which a thermal oxide layer (300 nm), Ta adhesion layer (30 nm), PVD copper

(1600 nm) were placed and the substrate was mounted onto a polisher and the test/comparative slurry was supplied to between the wafer and the pad at the rate of 120 mL/min. The polishing was conducted at 6 psi and 120 rpm followed by cleaning. The test/comparative showed the following results: Cu material removal rate (MRR) = 900/600; Ta MRR = 5/30; and oxide MRR = 0/30.

KW [1] 2006-0-0-0 CL; 0042-15101 CL; 0042-15102 CL; 0042-15103 CL;
0042-15104 CL; 0042-15105 CL; 0042-15106 CL; 414150-0-0-0 CL; 0042-15107
CL; 0042-15108 CL; 0042-15109 CL; 0042-15110 CL; 2211-0-0-1 CL; 12-0-0-0
CL; 104530-0-0-0 CL; 0042-15111 CL; 0042-15112 CL; 0042-15113 CL;
209-0-0-0 CL; 131645-0-0-0 CL; 130728-0-0-0 CL; 33-0-0-0 CL; 1017-0-0-0
CL; 200348-0-0-0 CL; 490-0-0-0 CL; 131436-0-0-0 CL; 0042-15114 CL;
0042-15115 CL
FS CPI EPI
FA AB; DCN
MC CPI: A12-A03; A12-E07C; E06-D08; E07-D13C; E10-A09A; E10-A16B; E10-A22;
E10-B02; E10-B02D6; E10-B03; E10-B04; E10-C02C2; E10-C02D2; E10-C04;
E10-E04H; E10-E04L3; E10-E04M3; E10-E04M4; E10-J02A2; E31-B03C;
E31-E; E31-N04A; E31-N05D; E32-A02; E33; E34; E35-H; L04-B04
EPI: U11-C06A
DRN 0104-U; 0113-U; 0271-U; 1512-U; 1713-U; 1732-U
PLE UPA 20011211

L12 ANSWER 2 OF 3 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD
AN 2001-488518 [53] WPIX
DNN N2001-361494 DNC C2001-146571
TI Chemical-mechanical **polishing** of semiconductor substrate comprising **tantalum** and non-**tantalum** metal conductor, includes applying metal-selective **polish** compositions and metal oxide abrasive.
DC A85 G02 L03 M13 M14 P61
IN CHOU, H; WANG, S
PA (CABO) CABOT MICROELECTRONICS CORP
CYC 94
PI WO 2001041973 A2 20010614 (200153)* EN 27p B24B037-00
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ
NL OA PT SD SE SL SZ TR TZ UG ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK DM
DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC
LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE
SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW
AU 2001043096 A 20010618 (200161) B24B037-00
US 6316365 B1 20011113 (200173) H01L021-302
ADT WO 2001041973 A2 WO 2000-US42522 20001201; AU 2001043096 A AU 2001-43096
20001201; US 6316365 B1 Provisional US 1999-169382P 19991207, US
2000-728779 20001201
FDT AU 2001043096 A Based on WO 200141973
PRAI US 1999-169382P 19991207; US 2000-728779 20001201
IC ICM B24B037-00; H01L021-302
ICS H01L021-461
AB WO 200141973 A UPAB: 20010919 ✓
NOVELTY - A substrate with **tantalum** (Ta) and non-Ta metal conductor is **polished** chemically-mechanically by applying to substrate a conductor-selective **polish** composition and metal oxide abrasive; removing conductor portion(s); applying Ta-selective **polish** composition having persulfate compound and passivation film-forming agent for the conductor, and metal oxide abrasive; and removing Ta portion(s).
USE - For planarizing semiconductor substrates comprising **tantalum** and a conductive metal e.g. copper.
ADVANTAGE - Planarization efficiency, uniformity, and removal rate are maximized. Undesirable effects, e.g. surface imperfections and damage to underlying topography, are minimized.
Dwg.0/0
TECH WO 200141973 A2UPTX: 20010919
TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Materials: The **tantalum** is in the form of **tantalum** metal or **tantalum** nitride. The metal conductor is copper (preferred), aluminum, aluminum silicon, titanium, titanium nitride, tungsten, tungsten nitride, gold, platinum, iridium, ruthenium, and/or their alloys. The metal oxide abrasive is alumina, silica, titania, ceria, zirconia, germania, and/or magnesia, or preferably fumed silica. The persulfate compound is a peroxymonosulfate acid, peroxydisulfate acid, or their salts, preferably ammonium peroxydisulfate. The substrate is silicon dioxide. Preferred Composition: The Ta-selective **polish** composition comprises (wt.%) metal oxide abrasive (2-30), persulfate compound (0.1-5), and film-forming agent (0.001-1, preferably 0.3-1). Preferred Method: The conductor-selective **polish** composition or the **polishing** process is adjusted to render the conductor-selective **polish** composition a Ta-selective **polish** composition. The adjustment includes increasing the pH of the **polishing** composition; increasing the concentration of the passivation film-forming agent; or decreasing **polishing**

aggressiveness by decreasing the pressure with which the pad and substrate are contacted, decreasing the substrate carrier speed during contact, and/or decreasing the pad platen speed during contact. The metal oxide abrasive is fixed on a **polishing** pad.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Materials: The film-forming agent is a heterocyclic organic compound, preferably having at least one 5 or 6-membered heterocyclic ring as the active functional group; where the ring contains nitrogen atom(s). The agent can be **benzotriazole** (preferred), triazole, and/or benzimidazole.

TECHNOLOGY FOCUS - POLYMERS - Preferred Material: The **Ta**-selective **polish** composition further comprises **polyacrylamide** or polyurethane diol.

ABEX WO 200141973 A2UPTX: 20010919

EXAMPLE - Similar substrates of tantalum, copper, and silicon dioxide were polished with two polishing compositions comprising (wt.%) fumed silica (6), ammonium peroxydisulfate (1), polyacrylamide (0.25), and benzotriazole (BTA) in varying concentrations (i.e. 0.3 and 0.45). The composition with 0.45 wt.% BTA had a copper removal rate of 181 Angstrom/min, tantalum removal rate of 920 Angstrom/min, and a copper to tantalum removal rate ratio of 0.12. The composition with 0.3 wt.% BTA had a copper removal rate of 2592 Angstrom/min, tantalum removal rate of 860 Angstrom/min, and a copper to tantalum removal rate ratio of 3.01. These showed that polishing was controlled by changing the concentration of passivation film-forming agent.

FS CPI GMPI

FA AB

MC CPI: A12-A03; A12-E07C; G02-A05; G04-B04; L04-B04; M14-A01; M14-A02

PLE UPA 20010919

[1.1] 018; R00444 G0453 G0260 G0022 D01 D12 D10 D26 D51 D53 D58 D83
F70 F93; H0000; P0088

[1.2] 018; G1025-R G0997 D01 F28 F26; P1592-R F77 D01; H0011-R

[1.3] 018; ND01; Q9999 Q6791; Q9999 Q6600; Q9999 Q7476 Q7330

L12 ANSWER 3 OF 3 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD

AN 2000-292261 [25] WPIX

DNN N2000-219177 DNC C2000-088172

TI **Polishing** pad for chemical-mechanical planarization of microelectronic devices has reaction control elements distributed across exposed surface of suspension medium and defining part of the pad.

DC A88 L03 P61

IN CHOPRA, D

PA (MICR-N) MICRON TECHNOLOGY INC

CYC 1

PI US 6039633 A 20000321 (200025)* 15p B24B001-00

ADT US 6039633 A US 1998-164916 19981001

PRAI US 1998-164916 19981001

IC ICM B24B001-00

AB US 6039633 A UPAB: 20000524

NOVELTY - Reaction control elements (150) are distributed across at least the exposed surface of a suspension medium and define part of the pad (140). The elements are soluble in the planarizing fluid (180), imparting a chemical to the fluid that interacts with the microelectronic device substrate assembly.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for (a) a planarizing machine utilizing the **polishing** pad for planarization of microelectronic devices; and (b) a method of planarizing microelectronic devices using the pad.

USE - The **polishing** pad is used for mechanical or chemical-mechanical planarization of microelectronic devices, in the

presence of a planarizing fluid. Especially to remove metal cover layers by oxidizing using oxidant dissolved into the fluid from the pad (all claimed), such as semiconductor wafers and field emission displays.

ADVANTAGE - The yield of operable devices can be increased, due to improved control over the **polishing** and more uniform **polishing** rates.

DESCRIPTION OF DRAWING(S) - The drawing shows a detailed schematic cross section of the **polishing** pad.

polishing pad 140
backing film 142
control element 150
planarizing fluid 180
abrasive particles 182

Dwg.3/9

TECH US 6039633 A UPTX: 20000524

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - The reaction control elements contain an oxidant selected from potassium permanganate, hydrolysed ferric nitrate, potassium iodate, ammonium persulfate, ammonium molybdate and oxalic acid, to oxidize material on the device substrate. The **polishing** pad contains an abrasive (182) selected from aluminum oxide, cerium oxide, **tantalum** oxide, titanium oxide and silicon dioxide. The suspension medium is directly attached to a backing film (142), and attached to the pad body facing the device substrate. The reaction control elements may consist of a buffer selected from ammonium acetate, ammonium citrate, ammonium phosphate, and potassium hydrogen phthalate. Two different types of control elements may be present in two different regions of the pad. Preferred machine: The **polishing** pad may be in the form of a web-format pad wrapped around a supply roller, and taken up by a take-up roller.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - The reaction control elements contain an inhibitor selected from **benzotriazole**, mercapto benzothiazole, sodium silicate, ammonium borate, ammonium phosphate, tolyltriazole, **imidazole** and potassium dichromate. The reaction control elements may consist of a surfactant selected from **polyethylene** glycol, **polyoxyethylene** ether and propylene glycol, or consist of a thickener selected from **polyethylene** glycol and carbopol.

TECHNOLOGY FOCUS - POLYMERS - The pad body consists of polyurethane. The backing film may be Mylar (RTM).

FS CPI GMPI

FA AB; GI

MC CPI: A12-E07; A12-H; A12-S02; L04-C07C

PLE UPA 20000524

[1.1] 018; R00351 G1558 D01 D23 D22 D31 D42 D50 D73 D82 F47; P8004
P0975 P0964 D01 D10 D11 D50 D82 F34; P0055; H0000
[1.2] 018; R00351 G1558 D01 D23 D22 D31 D42 D50 D73 D82 F47; P8004
P0975 P0964 D01 D10 D11 D50 D82 F34; P0055; H0000; M9999
M2153-R; M9999 M2200
[1.3] 018; ND01; Q9999 Q7476 Q7330; K9416; Q9999 Q7976 Q7885
[1.4] 018; Q9999 Q9110
[2.1] 018; R00351 G1558 D01 D23 D22 D31 D42 D50 D73 D82 F47; P8004
P0975 P0964 D01 D10 D11 D50 D82 F34; P0055; H0000
[2.2] 018; G2357 G0975 D01 D12 D10 D23 D27 D32 D42 D55 D51 D57 D58 D76
F24 F34; R00446 G0282 G0271 G0260 G0022 D01 D12 D10 D26 D51 D53
D58 D60 D83 F36 F35; H0022 H0011; P0088
[2.3] 018; ND01; Q9999 Q7476 Q7330; K9416; Q9999 Q7976 Q7885
[2.4] 018; Q9999 Q9347
[3.1] 018; P1592-R F77 D01
[3.2] 018; P0884 P1978 P0839 H0293 F41 D01 D11 D10 D19 D18 D31 D50 D63

[3.3] D90 E21 E00; S9999 S1285-R
018; ND01; Q9999 Q7476 Q7330; K9416; Q9999 Q7976 Q7885

L4 22862 SEA FILE=WPIX 1,2,4-TRIAZOLE OR BENZOTRIAZOLE OR IMIDAZOLE OR
5-METHYLBENZIMIDAZOLE OR POLYANILINE OR INDIAZOLE OR PURINE OR
BTA
L5 22270 SEA FILE=WPIX PVA OR PAA OR GEO OR GPO OR DCA OR PEI OR
DMSIO-EO
L6 269703 SEA FILE=WPIX POLYVINYL ALCOHOL OR VINYL ACETATE OR POLYETHYLEN
E OR SORBITOL OR GLYCEROL OR POLYACRYLAMIDE OR ETHYLENE GLYCOL
OR GLYCEROL ETHOXYLATE OR DIMETHYLSILOXANE ETHYLENE OXIDE OR
POLYETHYLENE OXIDE OR POLYOXYETHYLENE OR GLYCEROL PROPOXYLATE
OR ?HEXYLAMINE OR POLYETHYLENEIMINE
L7 1879 SEA FILE=WPIX L4 AND (L5 OR L6)
L9 29624 SEA FILE=WPIX TA OR TANTALUM
L10 16 SEA FILE=WPIX L9 AND L7
L12 3 SEA FILE=WPIX (CMP OR POLISH?) AND L10
L13 35557 SEA FILE=WPIX TA OR TANTALUM OR B05-A03B/MC
L14 19 SEA FILE=WPIX L7 AND L13
L15 16 SEA FILE=WPIX L14 NOT L12
L16 2 SEA FILE=WPIX (CMP OR POLISH? OR BUFF? OR METALLOGRAPHY OR
SURFACE TREAT? OR GRIND? OR ABRASI?) AND L15

=> d max 1-

YOU HAVE REQUESTED DATA FROM 2 ANSWERS - CONTINUE? Y/(N):y

L16 ANSWER 1 OF 2 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD
AN 2001-168474 [17] WPIX
DNN N2001-121492 DNC C2001-050307
TI Etching solution for spin etch planarization of surfaces for fabricating
integrated circuits comprises an oxidizing reactant for forming a
passivation layer.
DC E19 L03 U11
IN LEVERT, J; TOWERY, D L
PA (ALLC) ALLIED-SIGNAL INC
CYC 83
PI WO 2001006555 A1 20010125 (200117)* EN 38p H01L021-321
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ
NL OA PT SD SE SL SZ TZ UG ZW
W: AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK EE ES FI GB GE
GH GM HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG
MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT UA UG
UZ VN YU ZW
AU 2000060809 A 20010205 (200128) H01L021-321
ADT WO 2001006555 A1 WO 2000-US18723 20000710; AU 2000060809 A AU 2000-60809
20000710
FDT AU 2000060809 A Based on WO 200106555
PRAI US 1999-356487 19990719
IC ICM H01L021-321
ICS C23F003-06
AB WO 200106555 A UPAB: 20010328
NOVELTY - An etching solution (9) comprises an oxidizing reactant for
forming a passivation layer; a depassivating co-reactant terminating the
passivation property; and adjusting mechanism for diffusion of the
reactants such that the rates of reactions in depressed regions of the
surface are diffusion-limited and have slower rates than reactions at
elevated regions of the surface.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for a
method of planarization of a substrate comprising spinning the substrate
having the face to be planarized upward; directing an etching solution on
the face of the substrate; and adjusting the diffusion of the oxidizing
reactant and the depassivating co-reactant.
USE - For spin etch planarization (SEP) of surfaces (8) for

fabricating integrated circuits.

ADVANTAGE - The invention provides planarization of a surface without mechanical contact or mechanical abrasion.

DESCRIPTION OF DRAWING(S) - The figure shows a schematic view of a SEP.

Surfaces 8

Etching solution 9

Dwg. 2/3

TECH WO 200106555 A1UPTX: 20010328

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Material: The surface is copper or **tantalum**. The oxidizing reactant is hydrogen peroxide (H₂O₂), nitric acid (HNO₃), and/or sodium chlorate. Preferred Reactant: The depassivating reactant is phosphoric acid, sulfuric acid, ammonium fluoride, copper (II) sulfate, HNO₃, hydrogen fluoride, H₂O₂, sodium hydroxide and/or potassium hydroxide. Preferred Component: The adjusting mechanism comprises an additive from hydrochloric acid, borax, zinc sulfate, silicon hexafluoride, heavy metal salts, salts of copper and **tantalum**, copper carbonate, copper (I) chloride, iron chloride, and/or potassium chloride. The etching solution comprises ammonium hydroxide, H₂O₂, sodium nitrate, mineral acid, sodium molybdate sulfuric acid, or molybdenum salt.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Component: The depassivating reactant is oxalic acid, acetic acid, and/or organic acids. The adjusting mechanism comprises an additive from aliphatic alcohols, butylated hydroxytoluene, 2,6-di-tert-butyl-4((dimethylamino)methyl)phenol, 2,6-di-tert-4N,N-dimethylaminomethylphenol, **ethylene glycol**, methanol, propanol, poly(oxyethylene)lauryl ether, malic acid, HOOC(CX₂)_nCOOH, 3% tartaric acid, 1% **ethylene glycol**, 1,2,4-triazole, 1,2,3-triazole, tetrazole, nonionic surfactant, ethanol, trifluoroethanol, organic salt surfactant, **polyvinyl alcohol**, diphenylsulfamic acid, sodium oxalate, **benzotriazole**, sodium lignosulfonate, glycol, gelatin carboxymethylcellulose, amines, propylene glycol, 2-ethyl-**hexylamine**, low molecular weight alcohols, glycols, phenols, aliphatic alcohols, polyvinylalcohols, anionic surfactants, cationic surfactants, fluorocarbon-based surfactants, nonionic surfactants, and/or ethylenediaminetetraacetic acid (EDTA), and/or **polyvinyl alcohol** solution stabilizers. The etching solution comprises EDTA, citric acid, erythorbic acid, triethanolamine, trisodium citrate, triethanolamine, or phenolsulfonic acid.

X = OH, amine, or H;

n = 1-4

ABEX WO 200106555 A1UPTX: 20010328

EXAMPLE - No relevant example given.

KW [1] 209-0-0-0 CL; 80-0-0-0 CL; 107325-0-0-0 CL; 63-0-0-0 CL; 7-0-0-0 CL; 95-0-0-0 CL; 1-0-0-0 CL; 1483-0-0-0 CL; 74-0-0-0 CL; 219-0-0-0 CL; 2-0-0-0 CL; 104530-0-0-0 CL; 0033-90604 CL; 9-0-0-0 CL; 69081-0-0-0 CL; 770-0-1-0 CL ST; 21-0-0-0 CL; 1577-0-0-0 CL; 15-0-0-0 CL; 331-0-0-0 CL; 72519-0-0-0 CL; 4073-0-0-0 CL; 2623-0-0-0 CL; 611-0-0-0 CL; 35701-0-0-0 CL; 2749-0-0-0 CL; 6-0-0-0 CL; 667-0-0-0 CL; 130265-0-0-0 CL; 104492-0-0-0 CL; 363820-0-0-0 CL; 130807-0-0-0 CL; 1056-0-0-0 CL; 95972-0-0-0 CL; 133912-0-0-0 CL; 861-0-0-0 CL; 16196-0-0-0 CL; 136-0-0-0 CL; 591-0-1-0 CL ST; 591-0-5-0 CL ST; 591-0-2-0 CL ST; 591-0-3-0 CL ST; 91577-0-0-0 CL; 245649-0-0-0 CL; 747-0-0-0 CL; 849-0-0-0 CL; 3330-0-0-0 CL; 17-0-0-0 CL; 138286-3-0-0 CL; 836-0-0-0 CL; 849-0-2-0 CL ST; 107347-0-0-0 CL; 2897-0-0-0 CL; 280170-0-0-0 CL; 191651-0-0-0 CL; 107470-0-0-0 CL; 132991-0-0-0 CL; 0033-90601 CL; 0033-90602 CL; 0033-90603 CL

FS CPI EPI

FA AB; GI; DCN

MC CPI: E05-A; E06-D08; E07-A02B; E07-D13C; E10-A08A; E10-A09B7; E10-B01C;
E10-B02B; E10-B03B; E10-B04; E10-B04D; E10-C02; E10-C04; E10-C04J2;
E10-E02E2; E10-E04H; E10-E04L; E10-E04M2; E10-E04M3; E31-B03C;
E31-B03D; E31-C; E31-E; E31-F05; E31-H05; E31-K05A; E31-P06B;
E31-Q06; E32-A04; E33-A03; E33-E; E35-A; E35-C; E35-N; E35-Q;
L04-C07C; L04-C12
EPI: U11-A10; U11-C07B
DRN 0137-U; 0195-U; 0245-U; 0247-U; 0270-U; 0302-U; 0419-U; 0540-U; 0615-U;
0743-U; 0822-U; 1090-U; 1152-U; 1512-U; 1514-U; 1529-U; 1534-U; 1656-U;
1682-U; 1696-U; 1704-U; 1711-U; 1712-U; 1714-U; 1724-U; 1732-U; 1741-U;
1759-U; 1764-U; 1835-U; 1844-U; 1946-U
CMC UPB 20010328

16 ANSWER 2 OF 2 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD
 AN 1990-345234 [46] WPIX
 DNN N1991-187493 DNC C1991-106688
 TI Secondary battery prepn. - using electroconductive polymer e.g. poly
 aniline, as positive electrode material.
 DC A85 E13 E17 L03 X16
 PA (RICO) RICOH KK
 CYC 2
 PI JP 02250273 A 19901008 (199046)* 9p
 US 5037713 A 19910806 (199134) 13p
 JP 2934449 B2 19990816 (199938) 4p H01M010-40
 ADT JP 02250273 A JP 1989-69303 19890323; US 5037713 A US 1990-495144
 19900319; JP 2934449 B2 JP 1989-69303 19890323
 FDT JP 2934449 B2 Previous Publ. JP 02250273
 PRAI JP 1989-69303 19890323
 IC H01M004-60; H01M010-40
 ICM H01M010-40
 ICS H01M004-02; H01M004-60
 AB JP 02250273 A UPAB: 19930928
 The solid electrolyte is shown as $\text{Li}_{1+x}\text{M}_x\text{Zr}_{2-x}(\text{PO}_4)_3$, where M=Al or rare
 earth metals, $x=0.1-0.9$, or $\text{Li}_{1-y}\text{L}_y\text{Zr}_{2-y}(\text{PO}_4)_3$, where L=V, Nb or
 Ta, $y=0.1-0.9$.
 USE ADVANTAGE - The solid electrolyte has high ion conductivity and
 stability at room temp., so it is applicable to micro battery. In an
 example, 1.8 pts. mole of ZrO_2 , 0.6 pts. mole. of LiCO_3 , 3 pts. mole of
 $(\text{NH}_4)_2\text{HPO}_4$ and 0.1 pts. mole of Al_2O_3 are mixed, reacted at 900 deg.C for
 2 hrs, gradually cooled down, **grinded** for 6hrs. dried at 100
 deg.C reacted at 90C for 2 hrs. gradually cooled down and ground for 12
 hrs. The **grinded** powder is dried added by 3wt.% PVA
 soln. (0.1 ml vs. 1g powder), molded and sintered at 1200 deg.C for 2 hrs.
 to form $\text{Li}_{1.2}\text{Al}_{0.2}\text{Zr}_1(\text{PO}_4)_3$. @ (9pp Dwg.No.0/0

L4 22862 SEA FILE=WPIX 1,2,4-TRIAZOLE OR BENZOTRIAZOLE OR IMIDAZOLE OR 5-METHYLBENZIMIDAZOLE OR POLYANILINE OR INDIAZOLE OR PURINE OR BTA

L5 22270 SEA FILE=WPIX PVA OR PAA OR GEO OR GPO OR DCA OR PEI OR DMSIO-EO

L6 269703 SEA FILE=WPIX POLYVINYL ALCOHOL OR VINYL ACETATE OR POLYETHYLENE OR SORBITOL OR GLYCEROL OR POLYACRYLAMIDE OR ETHYLENE GLYCOL OR GLYCEROL ETHOXYLATE OR DIMETHYLSILOXANE ETHYLENE OXIDE OR POLYETHYLENE OXIDE OR POLYOXYETHYLENE OR GLYCEROL PROPOXYLATE OR ?HEXYLAMINE OR POLYETHYLENEIMINE

L7 1879 SEA FILE=WPIX L4 AND (L5 OR L6)

L9 29624 SEA FILE=WPIX TA OR TANTALUM

L10 16 SEA FILE=WPIX L9 AND L7

L12 3 SEA FILE=WPIX (CMP OR POLISH?) AND L10

L13 35557 SEA FILE=WPIX TA OR TANTALUM OR B05-A03B/MC

L14 19 SEA FILE=WPIX L7 AND L13

L15 16 SEA FILE=WPIX L14 NOT L12

L16 2 SEA FILE=WPIX (CMP OR POLISH? OR BUFF? OR METALLOGRAPHY OR SURFACE TREAT? OR GRIND? OR ABRASI?) AND L15

L17 122 SEA FILE=WPIX (CMP OR POLISH? OR BUFF? OR METALLOGRAPHY OR SURFACE TREAT? OR ABRASI?) AND L7

L18 613947 SEA FILE=WPIX (H01L? OR B24B?)/IC

L19 11 SEA FILE=WPIX L17 AND L18

L20 7 SEA FILE=WPIX L19 NOT (L12 OR L16)

=> d max 1-

YOU HAVE REQUESTED DATA FROM 7 ANSWERS - CONTINUE? Y/(N):y

L20 ANSWER 1 OF 7 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD

AN 2001-560273 [63] WPIX

DNN N2001-416509

TI **Polishing** method comprises pressing substrate having metal laminate film which has roughness on surface onto **abrasive** cloth bonded on **polishing** board.

DC P61 U11

PA (HITB) HITACHI CHEM CO LTD

CYC 1

PI JP 2001144055 A 20010525 (200163)* 7p H01L021-304 <--

ADT JP 2001144055 A JP 1999-321717 19991111

PRAI JP 1999-321717 19991111

IC ICM H01L021-304

ICS B24B037-00; H01L021-306

AB JP2001144055 A UPAB: 20011031

NOVELTY - **Polishing** method comprises pressing a substrate having a metal laminate film which has roughness on the surface onto an **abrasive** cloth bonded on a **polishing** board. The substrate and the **polishing** board are moved relatively while supplying **polishing** liquid to the **abrasive** cloth to flatten the roughness.

DETAILED DESCRIPTION - The grinding cloth is washed with a washing liquid and the metal laminate film is ground.

USE - Used for the **polishing** of a substrate which has a metal laminated film.

ADVANTAGE - The dishing amount is reduced and chemical-mechanical **polishing** speed is not reduced.

Dwg.0/0

TECH JP 2001144055 AUPTX: 20011031

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Method: The washing liquid comprises an organic acid, organic acid ester and/or an ammonium salt of the organic acid. The **polishing** liquid contains metal

oxidizing agent, metal oxide solubilizing agent, a protective film forming agent, water-soluble polymer and water. The metal oxidation agent is hydrogen peroxide, nitric acid, K periodate, hypochlorous acid and/or ozone. The metal oxide solubilizing agent is an organic acid, organic acid ester, an ammonium salt of the organic acid and/or sulphuric acid. The organic acid is malic acid, citric acid, tartaric acid and/or glycolic acid. The protective film forming agent is a **benzotriazole** and/or its derivatives. The water-soluble polymer is a polyacrylic acid and/or a polyacrylate. The **abrasive** cloth comprises urethane, **polyethylene**, polypropylene, polystyrene, polycarbonate, PTFE and/or an ionomer.

FS EPI GMPI
FA AB
MC EPI: U11-C06A1A

L20 ANSWER 2 OF 7 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD

AN 2001-560269 [63] WPIX

DNN N2001-416505

TI **Polishing** method comprises pressing substrate having metal laminate film which has roughness on surface onto **abrasive** cloth bonded on **polishing** board.

DC P61 U11

PA (HITB) HITACHI CHEM CO LTD

CYC 1

PI JP 2001144043 A 20010525 (200163)* 8p H01L021-304 <--

ADT JP 2001144043 A JP 1999-321716 19991111

PRAI JP 1999-321716 19991111

IC ICM H01L021-304

ICS B24B037-00

AB JP2001144043 A UPAB: 20011031

NOVELTY - **Polishing** method comprises pressing a substrate having a metal laminate film which has roughness on the surface onto an **abrasive** cloth bonded on a **polishing** board. The substrate and the **polishing** board are moved relatively while supplying **polishing** liquid to the **abrasive** cloth to flatten the roughness.

DETAILED DESCRIPTION - A grinding cloth is used which contains grinding particles in the cloth, and a grinding liquid containing no grinding particles or a grinding liquid containing up to 1 weight% grinding particles is used.

USE - Used for the **polishing** of a substrate which has a metal laminated film.

ADVANTAGE - The dishing amount is reduced and chemical-mechanical **polishing** speed is not reduced.

Dwg.0/0

TECH JP 2001144043 AUPTX: 20011031

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Materials: The **polishing** liquid contains metal oxidizing agent, metal oxide solubilizing agent, a protective film forming agent, water-soluble polymer and water. The metal oxidation agent is hydrogen peroxide, nitric acid, K periodate, hypochlorous acid and/or ozone. The metal oxide solubilizing agent is an organic acid, organic acid ester, an ammonium salt of the organic acid and/or sulphuric acid. The organic acid is malic acid, citric acid, tartaric acid and/or glycolic acid. The protective film forming agent is a **benzotriazole** and/or its derivatives. The water-soluble polymer is a polyacrylic acid and/or a polyacrylate. The **abrasive** cloth comprises urethane, **polyethylene**, polypropylene, polystyrene, polycarbonate, PTFE and/or an ionomer.

FS EPI GMPI
FA AB
MC EPI: U11-C06A1A

L20 ANSWER 3 OF 7 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD
AN 2001-303130 [32] WPIX
DNN N2001-217772 DNC C2001-093197
TI **Polishing** liquid for metals used for wiring semiconductor devices, comprises protective-coat agent, water-soluble polymer, metal oxidizing agent and alpha-oxyacid with one carboxy group, and has preset pH.
DC E19 L03 M14 P61 U11
PA (HITB) HITACHI CHEM CO LTD
CYC 1
PI JP 2000336345 A 20001205 (200132)* 5p C09K003-14
ADT JP 2000336345 A JP 1999-148379 19990527
PRAI JP 1999-148379 19990527
IC ICM C09K003-14
ICS **B24B037-00**; C09K013-06; C23F001-16; **H01L021-304**;
H01L021-308
AB JP2000336345 A UPAB: 20010611
NOVELTY - A metal **polishing** liquid comprises a protective coat forming agent, a water-soluble polymer, a metal oxidizing agent, and alpha-oxyacid with a carboxy group, and has a pH of 2-5.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for a **polishing** method which involves removing a part of the metal wiring film by grinding the laminated films containing copper, copper alloys or other metals, on wiring board, with the **polishing** liquid.
USE - Used for sanding in metal wiring layer formation, in semiconductor devices.
ADVANTAGE - The process liquid displays efficient chemical-mechanical **polishing** property, with high **polishing** velocity. The **polishing** liquid forms a reliable implanted pattern with improved etching inhibitory effect.
Dwg.0/0
TECH JP 2000336345 AUPTX: 20010611
TECHNOLOGY FOCUS - POLYMERS - Preferred Composition: The **polishing** liquid, comprises a water soluble polymer such as polyacrylic acid or its salt, polymethacrylate or its salt, polyacrylamine, **polyvinyl alcohol** and/or polyvinyl pyrrolidone.
TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Components: The alpha-oxyacid with a carboxy group is preferably glycolic acid. The protective coat forming agent is benzotriazol (**BTA**) and/or its derivative. The metal oxidizing agent is hydrogen peroxide, nitric acid, potassium periodate, hypochlorous acid and/or ozone water. The **polishing** liquid, in addition, comprises solid grinding particles such as colloidal silica with a mean particle diameter of 100 nm or less, and/or colloidal alumina.
KW [1] 7560-0-0-0 CL; 1056-0-0-0 CL; 209-0-0-0 CL; 80-0-0-0 CL; 742-0-0-0 CL; 2355-0-0-0 CL; 103087-0-0-0 CL
FS CPI EPI GMPI
FA AB; DCN
MC CPI: E06-D08; E10-C04D5; E31-C; E31-D03; E31-E; E31-H05; L04-C10A; L04-C26; M14-A03
EPI: U11-C04D; U11-C06A1A
DRN 0448-U; 0615-U; 1724-U; 1732-U; 1887-U
CMC UPB 20010611
M3 *01* H4 H401 H481 H8 J0 J011 J1 J171 M280 M311 M321 M342 M349 M381 M391 M423 M620 M782 M904 M905 M910 Q454 Q465 R023
DCN: R00448-K; R00448-M; R09538-K; R09538-M
M3 *02* D000 D810 M280 M320 M412 M511 M520 M530 M540 M782 M904 M905 M910 Q454 Q465 R023

DCN: R00615-K; R00615-M
M3 *03* C101 C408 C550 C730 C800 C801 C802 C804 C805 C807 M411 M782 M904
M905 M910 Q454 Q465 R023
DCN: R01732-K; R01732-M
M3 *04* C101 C108 C307 C510 C730 C800 C801 C802 C804 C807 M411 M782 M904
M905 M910 Q454 Q465 R023
DCN: R01724-K; R01724-M
M3 *05* A119 A940 C053 C108 C300 C730 C801 C803 C804 C805 C807 M411 M782
M904 M905 Q454 Q465 R023
DCN: R06083-K; R06083-M
M3 *06* C017 C100 C101 C108 C730 C800 C801 C804 C805 C807 M411 M782 M904
M905 Q454 Q465 R023
DCN: R08430-K; R08430-M
M3 *07* C408 C550 C810 M411 M782 M904 M905 M910 Q454 Q465 R023
DCN: R01887-K; R01887-M

L20 ANSWER 4 OF 7 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD
AN 2001-060851 [07] WPIX
DNN N2001-045635 DNC C2001-016722
TI Grinding a surface of a workpiece for glass articles used in, e.g. lenses,
involves contacting a grinding layer of an article having **abrasive**
composites with the workpiece and introducing a lubricant between the
layer and the workpiece.
DC A88 E19 G04 L01 L02 P61
IN WOO, E J
PA (MINN) 3M INNOVATIVE PROPERTIES CO
CYC 91
PI WO 2000064630 A1 20001102 (200107)* EN 66p B24B007-24 <--
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW NL
OA PT SD SE SL SZ TZ UG ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY CA CH CN CR CU CZ DE DK DM DZ
EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK
LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI
SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW
AU 2000046524 A 20001110 (200109) B24B007-24 <--
ADT WO 2000064630 A1 WO 2000-US10747 20000420; AU 2000046524 A AU 2000-46524
20000420
FDT AU 2000046524 A Based on WO 200064630
PRAI US 1999-130797P 19990423
IC ICM B24B007-24
ICS B24D003-28; B24D003-34; B24D007-06
AB WO 200064630 A UPAB: 20010202
NOVELTY - A surface of a glass workpiece is ground by contacting a
grinding layer of an **abrasive** article containing
abrasive composite with the surface of the glass workpiece;
introducing a lubricant between the grinding layer of the article and the
workpiece; and moving the grinding layer and the workpiece relative to one
another.
DETAILED DESCRIPTION - Grinding a surface of a glass workpiece
includes:
(a) contacting a grinding layer of an **abrasive** article
containing **abrasive** composite (11) with the surface of the glass
workpiece;
(b) introducing a lubricant between the grinding layer of the article
and the workpiece; and
(c) moving the grinding layer and the workpiece relative to one
another. The grinding layer includes **abrasive** composites
containing organic resin, a metal salt, an single diamond **abrasive**
particles dispersed homogeneously throughout the composites. The metal
salt can be alkali and/or alkaline metal salts.
USE - For use in grinding a surface of a glass workpiece for glass

articles, which are extensively found in homes, offices, and factories in the form of lenses, prisms, mirrors, cathode ray tube (CRT) screens, and other items.

ADVANTAGE - The **abrasive** article (10) does not exhibit the disadvantages associated with loose **abrasive** slurry, but is able to effectively and economically grind surface in a reasonable time by providing fast stock removal over a short period of time.

DESCRIPTION OF DRAWING(S) - The figure shows a perspective view of the **abrasive** article according to the invention.

Abrasive article 10

Abrasive composite 11

Backing 14

Dwg.1/7

TECH WO 200064630 A1UPTX: 20010202

TECHNOLOGY FOCUS - CERAMICS AND GLASS - Preferred Method: The method includes removing 200-400 mum (preferably 100 mum) of glass stock from the glass workpiece. It results a final surface roughness (Ra) of 1.1 mum (preferably 0.7 mum) or less. The glass stock is removed at 10-15 seconds time interval. The **abrasive** composites are integrally molded to a backing (14).

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Property: The diamond **abrasive** particles have an average particle size of 0.01-500 mum. Preferred Composition: The composite contains 1-30 pbw diamond particles, 70-99 pbw binder, and 40-60 wt.% (preferably 50-60 wt.%) filler. Preferred Binder: The permanent binder is glass, ceramic, metal, or organic.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Component: The lubricant contains a mixture of water and at least one additive. The additive can be amines, mineral oil, kerosene, mineral spirit, water-soluble oil emulsions, **ethylene glycol**, monoethanolamine, diethanolamine, triethanolamine, propylene glycol, amine borate, boric acid, amine carboxylate, pine oil, indoles, thioamine salt, amides, hexahydro-1,3,5-triethyltriazine, carboxylic acid, sodium 2-mercaptobenzothiazole, isopropanolamine, triethylenediamine tetraacetic acid, propylene glycol methyl ether, **benzotriazole**, sodium 2-pyridinethiol-1-oxide, hexylene glycol, or their mixtures. Preferred Filler: The filler is calcium metasilicate, white aluminum oxide, calcium carbonate, and/or silica.

TECHNOLOGY FOCUS - POLYMERS - Preferred Component: The backing contains urethane resin. The organic resin comprises epoxy resin. The lubricant may also contain a mixture of water and polyethylenimine.

KW [1] 2211-0-0-1 CL; 184613-0-0-0 CL; 103242-0-0-0 CL; 98629-0-0-0 CL; 173429-0-0-0 CL; 21-0-0-0 CL; 408-0-0-0 CL; 2406-0-0-0 CL; 836-0-0-0 CL; 861-0-0-0 CL; 93-0-0-0 CL; 104060-0-0-0 CL; 134453-0-0-0 CL; 82125-0-1-0 CL ST; 11256-0-0-0 CL; 2082-0-0-0 CL; 1056-0-0-0 CL; 3531-0-1-0 CL ST; 1950-0-0-0 CL; 0029-90701 CL; 0029-90702 CL; 0029-90703 CL; 0029-90704 CL; 0029-90705 CL; 0029-90706 CL.

FS CPI GMPI

FA AB; GI; DCN

MC CPI: A05-A01E; A05-G01E2; A05-J07; A12-A03; A12-H10; E06-D01; E06-D08; E06-F01; E07-D04A; E07-D13B; E10-B01C; E10-B03B; E10-B04; E10-C04; E10-D03; E10-E04H; E10-E04M4; E10-J02D3; E31-N04A; E31-Q05; G04-B04; L01-G06; L02-F05

DRN 0137-U; 0615-U; 0743-U; 0822-U; 0929-U; 1131-U; 1167-U; 1894-U

PLE UPA 20010202

L20 ANSWER 5 OF 7 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD

AN 2000-504873 [45] WPIX

DNN N2000-373259 DNC C2000-151462

TI Composition for **polishing** copper-containing semiconductor devices comprises etchant, azole, detergent, and liquid.

DC A97 E19 G04 L03 M12 M14 P61

IN CHENG, S; KING, D

PA (USNA) US SEC OF NAVY

CYC 1

PI US 6066028 A 20000523 (200045)* 5p B24B001-00 <--

ADT US 6066028 A US 1998-210710 19981214

PRAI US 1998-210710 19981214

IC ICM **B24B001-00**

AB US 6066028 A UPAB: 20000918

NOVELTY - The composition results in smooth, scratch-free semiconductor device surfaces which prevent the magnetic layers from coupling to each other.

DETAILED DESCRIPTION - A composition comprises less than 5 vol.% etchant; less than 1 wt.% azole; less than 2 vol.% detergent; and liquid (balance). The etchant is nitric acid (HNO₃), ammonium hydroxide, hydrogen peroxide, acetic acid and/or ammonium chloride. The azole is **benzotriazole** (C₆H₅N₃) and/or its derivatives. The liquid is alcohol and/or water.

An INDEPENDENT CLAIM is also included for a method of **polishing** a copper surface with the above composition until the desired smoothness is obtained.

USE - For **polishing** copper-containing semiconductor devices.

ADVANTAGE - The composition results in smooth, scratch-free semiconductor device surface having root mean square roughness of less than 6 Angstrom. The smooth scratch-free surface prevents the magnetic layers from coupling to each other.

Dwg.0/0

TECH US 6066028 A UPTX: 20000918

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Composition: The composition comprises azole (0.1-1 wt.%) from **benzotriazole** and detergent (0.1-2 vol.%). The detergent composition comprises (vol.%) tetrasodium ethylene diamine tetraacetate (1.4), triethanolamine (1.3), oleic acid (3.0), **polyethylene** glycol 400 (1.0), and Tergitol (R) (TM) (non-ionic surfactant) (1.8).

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Composition: The composition comprises etchant (0.5-5 vol.%) from nitric acid and deionized water (balance). The detergent composition comprises (vol.%) sodium carbonate (3.0) and water (88.5).

ABEX US 6066028 A UPTX: 20000918

EXAMPLE - The composition used to polish the copper layer was comprised of HNO₃ (1 vol.%), C₆H₅N₃ (0.1 wt.%), FL-70 (TM) (biodegradable detergent) (0.4 vol.%) and deionized water (balance). The composition was milky white and transparent. It had a consistency of water at ambient temperature and had a pH 6.

KW [1] 591-0-2-0 CL ST; 836-0-0-0 CL; 17-0-0-0 CL; 66-0-0-0 CL; 1-0-0-0 CL; 102701-0-0-0 CL; 80-0-0-0 CL; 209-0-0-0 CL; 107324-0-0-0 CL; 1056-0-0-0 CL; 900-0-0-0 CL; 0021-89501 CL; 0021-89503 CL; 0021-89502 CL

FS CPI GMPI

FA AB; DCN

MC CPI: A12-W12B; E06-D08; E10-B01C; E10-B03B; E10-C04J2; E10-C04L2; E31-E; E31-H05; E32-A04; E33-D; G04-B08; L04-B04; L04-C07C; M14-A03

DRN 0195-U; 0247-U; 0615-U; 0743-U; 0954-U; 1287-U; 1534-U; 1724-U; 1732-U; 1947-U; 2044-U

PLE UPA 20000918

[1.1] 018; R00351 G1558 D01 D23 D22 D31 D42 D50 D73 D82 F47; H0000;
H0237-R; P8004 P0975 P0964 D01 D10 D11 D50 D82 F34; P0055
[1.2] 018; ND01; Q9999 Q7034-R; Q9999 Q7476 Q7330; K9927

CMC UPB 20000918

M3 *01* A111 A960 H1 H103 H182 J0 J014 J1 J173 M280 M311 M312 M321
M323 M332 M342 M349 M381 M383 M391 M393 M411 M510 M520 M530 M540
M620 M630 M782 M904 M905 Q336 Q454 Q461 Q465 R023
DCN: R03804-K; R03804-M
M3 *02* H1 H103 H181 H4 H403 H483 H8 M280 M312 M323 M332 M342 M383
M393 M416 M620 M782 M904 M905 M910 Q336 Q454 Q461 Q465 R023
DCN: R00743-K; R00743-M; R14152-K; R14152-M
M3 *03* C101 C108 C500 C550 C730 C801 C802 C804 C807 M411 M782 M904 M905
M910 Q336 Q454 Q461 Q465 R023
DCN: R01534-K; R01534-M
M3 *04* C017 C100 C500 C730 C801 C804 C806 C807 M411 M782 M904 M905 M910
Q336 Q454 Q461 Q465 R023
DCN: R01947-K; R01947-M
M3 *05* J0 J011 J1 J171 M210 M211 M262 M281 M320 M416 M620 M782 M904
M905 M910 Q336 Q454 Q461 Q465 R023
DCN: R00247-K; R00247-M; R07345-K; R07345-M
M3 *06* H7 H721 J0 J011 J1 J171 M225 M231 M262 M281 M320 M416 M782
M904 M905 M910 Q336 Q454 Q461 Q465 R023
DCN: R00954-K; R00954-M; R14104-K; R14104-M
M3 *07* C101 C108 C307 C510 C730 C800 C801 C802 C804 C807 M411 M782 M904
M905 M910 Q336 Q454 Q461 Q465 R023
DCN: R01724-K; R01724-M
M3 *08* C101 C408 C550 C730 C800 C801 C802 C804 C805 C807 M411 M782 M904
M905 M910 Q336 Q454 Q461 Q465 R023
DCN: R01732-K; R01732-M
M3 *09* A111 A940 C106 C108 C530 C730 C801 C802 C803 C805 C807 M411 M782
M904 M905 M910 Q336 Q454 Q461 Q465 R023
DCN: R01287-K; R01287-M
M3 *10* D000 D810 M280 M320 M412 M511 M520 M530 M540 M782 M904 M905 M910
Q336 Q454 Q461 Q465 R023
DCN: R00615-K; R00615-M
M3 *11* H4 H402 H482 H5 H589 H8 M280 M312 M323 M332 M342 M383 M393
M423 M510 M520 M530 M540 M620 M782 M904 M905 M910 Q336 Q454 Q461
Q465 R023
DCN: R02044-K; R02044-M
M3 *12* D000 D021 D022 D023 D024 D025 D810 M280 M320 M412 M511 M520 M530
M540 M782 M904 M905 Q336 Q454 Q461 Q465 R023
DCN: 0021-89501-K; 0021-89501-M
M3 *13* D011 D021 D022 D023 D024 D025 D810 H2 H211 M210 M211 M212 M213
M214 M215 M216 M220 M221 M222 M223 M224 M225 M226 M231 M232 M233
M273 M280 M281 M320 M412 M511 M520 M530 M540 M782 M904 M905 Q336
Q454 Q461 Q465 R023
DCN: 0021-89503-K; 0021-89503-M
M3 *14* D012 D021 D022 D023 D024 D025 D810 H2 H211 M210 M211 M212 M213
M214 M215 M216 M220 M221 M222 M223 M224 M225 M226 M231 M232 M233
M273 M280 M281 M320 M412 M511 M520 M530 M540 M782 M904 M905 Q336
Q454 Q461 Q465 R023
DCN: 0021-89502-K; 0021-89502-M

L20 ANSWER 6 OF 7 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD

AN 2000-270896 [23] WPIX

DNN N2000-202927 DNC C2000-082542

TI **Abrasive** liquid for metal used in semiconductor wiring
manufacture comprises oxidizing agent, oxidized metal solvent, first and
second protecting film-forming agents and water.

DC A85 E19 L03 U11

IN HONMA, Y; HOSHINO, T; KAMIGATA, Y; KONDOH, S; MATSUZAWA, J; TERAZAKI, H;

UCHIDA, T
PA (HITB) HITACHI CHEM CO LTD; (HITA) HITACHI LTD
CYC 81
PI WO 2000013217 A1 20000309 (200023)* JA 35p H01L021-304 <--
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW NL
OA PT SD SE SL SZ UG ZW
W: AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK EE ES FI GB GE
GH GM HU ID IL IS JP KE KG KR KZ LC LK LR LS LT LU LV MD MG MK MN
MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT UA UG US UZ
VN YU ZW
AU 9954458 A 20000321 (200031) H01L021-304 <--
EP 1137056 A1 20010926 (200157) EN H01L021-304 <--
R: AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
ADT WO 2000013217 A1 WO 1999-JP4694 19990831; AU 9954458 A AU 1999-54458
19990831; EP 1137056 A1 EP 1999-940570 19990831, WO 1999-JP4694 19990831
FDT AU 9954458 A Based on WO 200013217; EP 1137056 A1 Based on WO 200013217
PRAI JP 1998-351188 19981210; JP 1998-245616 19980831
IC ICM H01L021-304
ICS C23F001-16; H01L021-308
AB WO 200013217 A UPAB: 20000516
NOVELTY - An **abrasive** liquid for metal comprises oxidizing
agent, oxidized metal solvent, a first protecting film-forming agent, a
second protecting film-forming agent which is different from the first,
and water.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for a
polishing method by **polishing** the metal film of an
abraded article surface in a **abrasive** liquid for metals.
USE - Used in wiring forming processes in semiconductor device
manufacture, and is used in the manufacture of semiconductor circuits such
as LSI devices.
ADVANTAGE - A buried pattern which has high reliability is formed by
lowering etching speed and maintaining high chemical-mechanical
polishing speed.
Dwg.0/0
TECH WO 200013217 A1UPTX: 20000516
TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Liquid: The first
protecting film-forming agent is at least one selected from ammonia,
amines, amino-acids, imines, azoles, mercaptans and saccharides,
especially **benzotriazole** and its derivatives, and is a compound
which forms a protective film by forming physical adsorption and/or
chemical bonds.
The second protecting film-forming agent is a compound having an alcoholic
or phenolic hydroxy group, an ester, an ether, a polysaccharide, an
amino-acid salt, a polycarboxylic acid or its salt, a vinyl polymer, an
amide, an azo compound or a molybdenum compound, such as polyacrylic acid,
polymethacrylic acid, polyamide acid, ammonium polyacrylate or
methacrylate, ammonium polyamide acid and/or **polyacrylamide**.
The second agent assists the first agent to form the protecting film.
The oxidizing agent is at least one of hydrogen peroxide, sulfuric acid,
potassium periodate, hypochlorous acid and ozonized water.
The oxidized metal solvent is at least one selected from malic acid,
tartaric acid, citric acid and their ammonium salts. The chemical
polishing speed is at least 100 nm/minute and the etching speed is
up to 10 nm/minute.
Metals containing copper, copper alloy and/or their oxides are
polished.
KW [1] 1056-0-0-0 CL; 6144-0-0-0 CL; 12-0-0-0 CL; 132352-0-0-0 CL;
135238-0-0-0 CL; 0015-16501 CL; 0015-16502 CL; 0015-16503 CL; 0015-16504
CL; 0015-16505 CL; 0015-16506 CL; 0015-16507 CL; 0015-16508 CL;
103087-0-0-0 CL; 7-0-0-0 CL; 209-0-0-0 CL; 742-0-0-0 CL; 2355-0-0-0 CL;
184614-0-0-0 CL; 104380-0-0-0 CL; 104379-0-0-0 CL

FS CPI EPI
FA AB; DCN
MC CPI: A12-A03; A12-E07C; E06-D08; E07-D13; E07-H; E10-A07; E10-A16B;
E10-B02B; E10-B04; E10-E02U; E10-E04; E10-G02H2; E10-H01E; E32-A02;
E35-Q; L04-C07C; L04-C10; L04-C26
EPI: U11-C04D; U11-C06A1A
DRN 0080-U; 0615-U; 1713-U; 1714-U; 1732-U; 1887-U
PLE UPA 20000516

L20 ANSWER 7 OF 7 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD
AN 1999-494139 [41] WPIX
DNN N1999-368089 DNC C1999-144804
TI High pixel density optical image sensors using organic semiconductor material.
DC A85 L03 U13 W04
IN YU, G
PA (UNIA-N) UNIAX CORP
CYC 84
PI WO 9939372 A2 19990805 (199941)* EN 63p H01L000-00 <--
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW NL
OA PT SD SE SZ UG ZW
W: AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK EE ES FI GB GD
GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV
MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT
UA UG UZ VN YU ZW
AU 9924923 A 19990816 (200002)
EP 1051752 A2 20001115 (200059) EN H01L027-00 <--
R: DE ES FI FR GB IT NL SE
CN 1296645 A 20010523 (200154) H01L051-20 <--
US 6300612 B1 20011009 (200162) H01L027-00 <--
KR 2001040506 A 20010515 (200167) H01L051-20 <--
ADT WO 9939372 A2 WO 1999-US2242 19990202; AU 9924923 A AU 1999-24923
19990202; EP 1051752 A2 EP 1999-904546 19990202, WO 1999-US2242 19990202;
CN 1296645 A CN 1999-804817 19990202; US 6300612 B1 Provisional US
1998-73347P 19980202, US 1999-241657 19990202; KR 2001040506 A KR
2000-708369 20000801
FDT AU 9924923 A Based on WO 9939372; EP 1051752 A2 Based on WO 9939372
PRAI US 1998-73347P 19980202; US 1999-241657 19990202
IC ICM H01L000-00; H01L027-00; H01L051-20
ICS H01L027-146
AB WO 9939372 A UPAB: 19991011
NOVELTY - Each photosensor comprises an active layer of organic semiconductor material sandwiched between two electrodes. A detector bridging the electrodes detects an electrical output in response to incident light. The spectral response of the sensors can be modified and adjusted as desired by material selection, device thickness adjustment or optical filtering.
USE - Monochromatic or multicolor response image sensors, useful for electronic cameras.
ADVANTAGE - The desired photo-response can be obtained in the IR, visible and UV ranges. Fabrication is relatively simple.
DESCRIPTION OF DRAWING(S) - The drawing shows the cross-section of a full color image element.
Electrodes 31
Blue sensor cathode (33) green and red sensor common electrode 32
Red sensor cathode 34
Blue sensor film b
Green sensor film g
Red sensor film r
Dwg.3a/19
TECH WO 9939372 A2 UPTX: 19991105
TECHNOLOGY FOCUS - ELECTRONICS - The sensor has second and third layers of different organic semiconductors on respective second and third parts of the first electrode with optical band-gaps corresponding to a different wavelength to that of the first organic semiconductor. Third and fourth electrodes are formed on the second and third organic semiconductors respectively. The second, third and fourth electrodes are transparent. The different parts of the first electrode are continuous or separate. The band-gaps of the first, second and third organic semiconductors

correspond to wavelengths of 500, 600 and 700 nm, acting as red, green and blue sensors respectively. The second organic material may cover the red sensor functioning as a short wavelength cut filter and the third organic material may cover the green and blue sensors and function as a mid wavelength cut filter.

Alternatively, the sensors may be in the order blue green and red, where the second material covers the blue sensor functioning as a mid wavelength cut filter and the first material covers the green and blue sensors and function as a short wavelength cut filter.

Alternatively, the different sensors and their respective electrodes are in a stacked configuration, with dielectric layers separating each individual element sensitive to a different wavelength. One or more variable color filters are used to discriminate the wavelengths, and consist of filter electrodes sandwiching a liquid crystal layer where the bias applied by the electrodes varies the wavelengths passed.

Alternatively, the wavelengths are discriminated by multiple etalons, a diffraction grating or a prism.

The electrodes are metal or conductive organic material.

A **buffer** layer of organic or organometallic material, or inorganic material such as LiF, NaF, BaO, Li₂O, Na₂O, other metal florets, metal oxides, metal sulfites, or a thin layer of metal alloys is positioned between an electrode and an adjacent photoactive organic material layer.

Inorganic and/or organic dielectric layers with different dielectric constants are arranged alternately to form diffractive Bragg deflector (DBR) optical mirrors which are incorporated into the electrodes to form a microcavity having a selected response at resonance wavelengths.

The support substrate has switching circuits hybridized with the sensor element.

TECHNOLOGY FOCUS - POLYMERS - A **buffer** layer of a conductive polymer selected from **polyaniline**, polypyrrole or **polyethylene** dioxythiophene polystyrene sulfonate is positioned between an electrode and an adjacent photoactive organic material layer.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - The organic material is an organometallic compound, conjugated polymer or semiconducting polymer, preferably a conjugated semiconducting polymer.

FS CPI EPI

FA AB; GI

MC CPI: A12-E07C; A12-L04B; L03-E05A

EPI: U13-A01X; W04-M01B5

DRN 1499-U; 1517-U; 1717-U; 1816-U; 1941-U

PLE UPA 20000617

[1.1] 018; P1127 P1105 H0293 D01 D19 D18 F07

[1.2] 018; P1412 H0293 P0044 D23 D22 D41 D51 D56 D59 F07

[1.3] 018; D24 D22 D32 D77 D43 D46 D86; G0191 G0102 G0022 D01 D12 D10
D19 D18 D31 D51 D53 D58 D60 D76 D88 F62; P1503 H0293 P0044 D01
D23 D22 D43 D51 D56 D59 F00; H0260; H0055 H0044 H0011; P0033;
P1741

[1.4] 018; ND01; Q9999 Q8355 Q8264; Q9999 Q7874; B9999 B3269 B3190;
K9483-R; Q9999 Q7512; K9836 K9790; K9870 K9847 K9790; K9869
K9847 K9790

L4 22862 SEA FILE=WPIX 1,2,4-TRIAZOLE OR BENZOTRIAZOLE OR IMIDAZOLE OR
5-METHYLBENZIMIDAZOLE OR POLYANILINE OR INDIAZOLE OR PURINE OR
BTA
L5 22270 SEA FILE=WPIX PVA OR PAA OR GEO OR GPO OR DCA OR PEI OR
DMSIO-EO
L6 269703 SEA FILE=WPIX POLYVINYL ALCOHOL OR VINYL ACETATE OR POLYETHYLEN
E OR SORBITOL OR GLYCEROL OR POLYACRYLAMIDE OR ETHYLENE GLYCOL
OR GLYCEROL ETHOXYLATE OR DIMETHYLSILOXANE ETHYLENE OXIDE OR
POLYETHYLENE OXIDE OR POLYOXYETHYLENE OR GLYCEROL PROPOXYLATE
OR ?HEXYLAMINE OR POLYETHYLENEIMINE
L21 195 SEA FILE=COMPENDEX L4 AND (L5 OR L6)
L25 3 SEA FILE=COMPENDEX (CMP OR ?POLISH? OR BUFFING OR BUFF) AND
L21

=> d all 1-

YOU HAVE REQUESTED DATA FROM 3 ANSWERS - CONTINUE? Y/(N):y

L25 ANSWER 1 OF 3 COMPENDEX COPYRIGHT 2001 EI
AN 2000(14):1228 COMPENDEX
TI **Benzotriazole** as inhibitor for copper with and without corrosion
products in aqueous **polyethylene glycol**.
AU Guilminot, E. (Domaine Universitaire, Saint Martin d'Herès, Fr); Rameau,
J.-J.; Dalard, F.; Degrigny, C.; Hiron, X.
SO Journal of Applied Electrochemistry v 30 n 1 2000.p 21-28
CODEN: JAELEJ ISSN: 0021-891X
PY 2000
DT Journal
TC Experimental
LA English
AB Electrochemical methods, including polarization experiments and impedance
spectroscopy, were used to evaluate the effectiveness of
benzotriazole (BTA) in an aqueous solution of
polyethylene glycol (PEG) in protecting **polished**
archaeological copper or archaeological copper covered with corrosion
products. The adsorption of PEG on the **polished** copper
significantly limited the corrosion current. The presence of
benzotriazole enhanced the protection of the **polished**
copper, giving maximum protection at a concentration of 10 minus 2 mol l
minus 1 of **BTA** in 20 vol% PEG 400 solution. On the other hand,
PEG solutions caused degradation of the corrosion products of the
copper. This degradation increased with time. When **BTA** was added,
the corrosion products were preserved and, the higher the **BTA**
concentration, the more the corrosion current decreased. In PEG 400
solution protection of the corrosion products of the copper by **BTA**
improved over time. (Author abstract) 17 Refs.
CC 539.2.1 Protection Methods; 803 Chemical Agents; 539.2 Corrosion
Protection; 539.1 Metals Corrosion; 801.4.1 Electrochemistry; 802.2
Chemical Reactions
CT *Corrosion inhibitors; Electric currents; Nitrogen compounds; Aromatic
compounds; Copper corrosion; **Polyethylene glycols**; Adsorption;
Polarization; Corrosion protection; Electrochemical corrosion
ST **Benzotriazole**

L25 ANSWER 2 OF 3 COMPENDEX COPYRIGHT 2001 EI
AN 1996(51):1311 COMPENDEX
TI Stabilization of alumina slurry for chemical-mechanical **polishing**
of copper.
AU Luo, Q. (Clarkson Univ, Potsdam, NY, USA); Babu, S.V.; Campbell, D.R.
SO Langmuir v 12 n 15 Jul 24 1996.p 3563-3566
CODEN: LANGD5 ISSN: 0743-7463

PY 1996
 DT Journal
 TC Experimental; Application
 LA English
 AB Stabilization of alumina slurries containing Fe(NO₃)₃ and **benzotriazole (BTA)** for chemical/mechanical **polishing (CMP)** of copper in acidic media was investigated. Slurry stability was evaluated from the initial settling rate of alumina particles in well-dispersed slurries. zeta potential and FTIR spectroscopy were employed to elucidate the observed effects. Fe³ plus , used as an etchant for copper, did not affect the slurry stability significantly, especially at low concentrations (less than 0.05 M). However, **BTA** worsened the stability, especially at higher concentrations, by reducing the electrostatic repulsion between alumina particles. This was confirmed by a drop in the measured zeta potential. FTIR spectra showed that **BTA** is chemisorbed onto alumina particle surfaces. Finally, the addition of poly(**ethylene glycol**) (MW equals 1000000) improved the slurry stability significantly and a stable alumina slurry for the **CMP** of copper was obtained. Preliminary data on the removal rates of copper and the selectivities of removal between SiO₂ and Cu using these slurries are reported. (Author abstract) 16 Refs.

CC 812.1 Ceramics; 544.1 Copper; 815.1 Polymeric Materials; 802.3 Chemical Operations; 801.3 Colloid Chemistry; 604.2 Machining Operations
 CT *Alumina; **Polishing**; Stability; Fourier transform infrared spectroscopy; **Polyethylene** glycols; Adsorption; Colloid chemistry; Copper
 ST Benzotriazoles; Slurry stability; Zeta potentials; Chemical mechanical **polishing**
 ET Fe*N*O; Fe(NO₃)₃; Fe cp; cp; N cp; O cp; O*Si; SiO₂; Si cp; Cu

L25 ANSWER 3 OF 3 COMPENDEX COPYRIGHT 2001 EI
 AN 1986(12):201614 COMPENDEX
 TI NEW METHOD OF CHEMICAL TREATMENT FOR BRASS SURFACE.
 AU Han, Wen-an, (Acad Sinica, Shenyang, China); Sun, Yan-fei; Shi, Zong-wu
 MT 4th Asian-Pacific Corrosion Control Conference: Material Conservation & Corrosion Control.
 ML Tokyo, Jpn
 MD 26 May 1985-31 May 1985
 SO v 2 p 902-907
 PY 1985
 MN 08657
 DT Conference Article
 LA English
 AB A brass surface tarnishes when exposed to the atmosphere. A new method of chemical treatment is suggested in this paper. The procedures treatment are alkali cleaning, acid pickling, chemical **polishing**, **benzotriazole** treatment, **PVA** treatment, drying. By means of this chemical treatment a complex film formed on the brass surface structure of Cu-Zn formed is golden in colour. After treatment the corrosion resistance to 3% NaCl solution and water vapour are better than a chromic acid treatment. This method is also applicable to copper. (Edited author abstract) 7 refs.

CC 544 Copper & Alloys; 546 Lead, Tin, Zinc, Antimony & Alloys; 539 Metals Corrosion & Protection; 804 Chemical Products
 CT *COPPER ZINC ALLOYS: Protective Coatings; SODIUM CHLORIDE; COPPER AND ALLOYS: Protective Coatings
 ST **BENZOTRIAZOLE (BTA)**; **PVA TREATMENT**; SODIUM CHLORIDE SOLUTIONS; TARNISHING; X-RAY PHOTOELECTRON SPECTROSCOPY (XPS); SURFACE TREATMENT
 ET Cu*Zn; Cu sy 2; sy 2; Zn sy 2; Cu-Zn; Cl*Na; NaCl; Na cp; cp; Cl cp

L4 22862 SEA FILE=WPIX 1,2,4-TRIAZOLE OR BENZOTRIAZOLE OR IMIDAZOLE OR
5-METHYLBENZIMIDAZOLE OR POLYANILINE OR INDIAZOLE OR PURINE OR
BTA
L5 22270 SEA FILE=WPIX PVA OR PAA OR GEO OR GPO OR DCA OR PEI OR
DMSIO-EO
L6 269703 SEA FILE=WPIX POLYVINYL ALCOHOL OR VINYL ACETATE OR POLYETHYLEN
E OR SORBITOL OR GLYCEROL OR POLYACRYLAMIDE OR ETHYLENE GLYCOL
OR GLYCEROL ETHOXYLATE OR DIMETHYLSILOXANE ETHYLENE OXIDE OR
POLYETHYLENE OXIDE OR POLYOXYETHYLENE OR GLYCEROL PROPOXYLATE
OR ?HEXYLAMINE OR POLYETHYLENEIMINE
L9 29624 SEA FILE=WPIX TA OR TANTALUM
L26 83 SEA FILE=INSPEC L4 AND (L5 OR L6).
L29 2788 SEA FILE=INSPEC CMP OR CHEM?(3A)POLISH?
L30 51 SEA FILE=INSPEC L9 AND L29
L31 21 SEA FILE=INSPEC (SOLUTION OR SLURR? OR L26) AND L30
L32 12 SEA FILE=INSPEC (CIRCUIT? OR WAFER OR PLATEN) AND L31

=> d all 1-

YOU HAVE REQUESTED DATA FROM 12 ANSWERS - CONTINUE? Y/(N):y

L32 ANSWER 1 OF 12 INSPEC COPYRIGHT 2001 IEE
AN 2001:7095049 INSPEC DN B2002-01-2550F-001
TI Chemical mechanical planarization of copper and barrier layers by
manganese(IV) oxide **slurry**.
AU Hara, T. (Hosei Univ., Tokyo, Japan); Kurosu, T.; Doy, T.
SO Electrochemical and Solid-State Letters (Dec. 2001) vol.4, no.12,
p.G109-11. 13 refs.
Doc. No.: S1099-0062(01)00712-X
Published by: Electrochem. Soc
Price: CCCC 1099-0062/2001/4(12)/109/3/\$7.00
CODEN: ESLEF6 ISSN: 1099-0062
SICI: 1099-0062(200112)4:12L.g109:CMPC;1-T
DT Journal
TC Experimental
CY United States
LA English
AB Deep dishing and erosion are serious problems in conventional chemical
mechanical planarization (**CMP**) of copper/barrier layer,
specifically when a hard barrier layer is used as the polishing stopper.
This paper describes the reduction of the dishing in the **CMP**
with lower removal rate ratio. This **CMP** can be achieved by
following procedures. (i) Increase of removal rate in barrier layer;
removal rate is 1.5 nm/min in polycrystalline **tantalum** nitride
barrier layer. This rate increases to 77 nm/min in TaSiN barrier layer
when polished by MnO2 **slurry** with hard pad. (ii) Reduction of
the removal rate of copper layer; removal rate of electroplated copper
layer decreases to 210 nm/min by MnO2 **slurry**. This rate
decreases to 77 nm/min when additive is doped into this **slurry**
by 10%. Because thin antioxide layer is formed at the copper surface
during the polishing by this additive, removal rate ratio of Cu/barrier
layer reduces to unity by this doping. Dishing free **CMP** can be
developed by this process.
CC B2550F Metallisation and interconnection technology; B2550E Surface
treatment (semiconductor technology)
CT **CHEMICAL MECHANICAL POLISHING; COPPER; DIFFUSION**
BARRIERS; INTEGRATED CIRCUIT INTERCONNECTIONS; SILICON
COMPOUNDS; TANTALUM COMPOUNDS; X-RAY PHOTOELECTRON SPECTRA
ST chemical mechanical planarization; **manganese oxide slurry**; deep
dishing; erosion; conventional chemical mechanical planarization;
copper/barrier layer; polishing stopper; removal rate;

polycrystalline tantalum nitride barrier layer; TaSiN barrier layer; MnO2 slurry; electroplated copper layer removal rate; thin antioxide layer; polishing; Cu/barrier layer; XPS; Cu-TaN; TaN; Cu-TaSiN; TaSiN; MnO2

CHI Cu-TaN int, TaN int, Cu int, Ta int, N int, TaN bin, Ta bin, N bin, Cu el; TaN sur, Ta sur, N sur, TaN bin, Ta bin, N bin; Cu-TaSiN int, TaSiN int, Cu int, Si int, Ta int, N int, TaSiN ss, Si ss, Ta ss, N ss, Cu el; TaSiN sur, Si sur, Ta sur, N sur, TaSiN ss, Si ss, Ta ss, N ss; MnO2 bin, Mn bin, O2 bin, O bin

ET N*Si-Ta; N sy 3; sy 3; Si sy 3; Ta sy 3; TaSiN; Ta cp; cp; Si cp; N cp; Mn*O; MnO2; Mn cp; O cp; Cu; Cu*N-Ta; Cu sy 3; TaN; Cu-TaN; N-Ta; Cu*N*Si-Ta; Cu sy 4; sy 4; N sy 4; Si sy 4; Ta sy 4; Cu-TaSiN; Ta; N; Si; MnO; Mn; O

L32 ANSWER 2 OF 12 INSPEC COPYRIGHT 2001 IEE
 AN 2001:7074377 INSPEC DN B2001-12-2550F-035
 TI Chemically induced defects during copper polish.
 AU Miller, A.E.; Fischer, P.B.; Feller, A.D.; Cadien, K.C. (Intel Corp., Hillsboro, OR, USA)
 SO Proceedings of the IEEE 2001 International Interconnect Technology Conference (Cat. No.01EX461)
 Piscataway, NJ, USA: IEEE, 2001. p.143-5 of iii+300 pp. 10 refs.
 Conference: Burlingame, CA, USA, 4-6 June 2001
 Sponsor(s): IEEE Electron Devices Soc
 Price: CCCC 0 7803 6678 6/2001/\$10.00
 ISBN: 0-7803-6678-6
 DT Conference Article
 TC Experimental
 CY United States
 LA English
 AB A high yielding copper damascene process requires defect-free copper surfaces after Cu polish. Critical defects derive from corrosion processes such as pitting corrosion, galvanic corrosion and excess etching. Changes in process conditions for Cu polish as well as the interaction with Ta polish step in a two-step (Cu/Ta) Ta polish can assist in defect reduction. Since these corrosion defects derive from the slurry chemistry itself, their quantities can be significantly reduced but not eliminated with process module changes.

CC B2550F Metallisation and interconnection technology; B2550E Surface treatment (semiconductor technology)

CT CHEMICAL MECHANICAL POLISHING; COPPER; CORROSION; ETCHING; INTEGRATED CIRCUIT INTERCONNECTIONS; INTEGRATED CIRCUIT METALLISATION

ST defect-free copper surfaces; high-yielding damascene process; chemically induced defects; pitting corrosion; galvanic corrosion; excess etching; process conditions; two-step polish; defect reduction; process module changes; CMP; low pH; module level interactions; Cu

CHI Cu sur, Cu el; Cu int, Cu el
 ET Cu; Ta

L32 ANSWER 3 OF 12 INSPEC COPYRIGHT 2001 IEE
 AN 2001:7027144 INSPEC DN B2001-10-2550F-030
 TI Chemical-mechanical planarization of Cu and Ta.
 AU Babu, S.V. (Dept. of Chem. Eng., Clarkson Univ., Potsdam, NY, USA); Li, Y.; Jindal, A.
 SO JOM (June 2001) vol.53, no.6, p.50-2. 15 refs.
 Published by: Minerals, Metals & Mater. Soc
 CODEN: JOMMER ISSN: 1047-4838
 SICI: 1047-4838(200106)53:6L:50:CM;1-M
 DT Journal
 TC Practical; Experimental

CY United States
 LA English
 AB As device dimensions continue to shrink, multilevel (>8) interconnects are required to efficiently implement complex logic device designs in a single silicon chip. When the number of metal interconnect levels increases, the available depth-of-focus budget of lithographic tools imposes stringent planarity requirements that can only be met currently by chemical-mechanical planarization (CMP). Improved speed and performance are extracted from such devices by switching to copper from Al/Cu as the interconnect metal to a lower dielectric constant inner layers. Use of copper also requires the simultaneous introduction of diffusion-barrier/adhesion-promotion layers of **tantalum** or TaN. This paper reviews some of the recent advances in the fundamental understanding of the interplay between the mechanical and chemical components of the material-removal process during CMP of copper and **tantalum** films. The emphasis is on the role of different process variables in **slurries** containing silica or alumina abrasives in hydrogen peroxide/glycine solutions.

CC B2550F Metallisation and interconnection technology; B2550E Surface treatment (semiconductor technology); B2810 Dielectric materials and properties; B2570 Semiconductor integrated circuits; B2530D Semiconductor-metal interfaces

CT ABRASION; CHEMICAL INTERDIFFUSION; **CHEMICAL MECHANICAL POLISHING**; COPPER; DIELECTRIC THIN FILMS; DIFFUSION BARRIERS; INTEGRATED **CIRCUIT** INTERCONNECTIONS; INTEGRATED **CIRCUIT** METALLISATION; PERMITTIVITY; SURFACE CHEMISTRY; **TANTALUM**

ST **Cu-Ta chemical-mechanical planarization**; device dimensions; multilevel interconnects; logic device designs; silicon chip; metal interconnect levels; depth-of-focus budget; lithographic tools; planarity requirements; chemical-mechanical planarization; **CMP**; copper interconnect metal; **Ta diffusion-barrier/adhesion-promotion layers**; TaN diffusion-barrier/adhesion-promotion layers; material-removal process; process variables; **tantalum films**; copper films; **slurries**; alumina abrasives; silica abrasives; hydrogen peroxide/glycine solutions; **Cu-Ta**; Cu-TaN; AlCu; H2O2; SiO2; Al2O3

CHI Cu-Ta int, Cu int, Ta int, Cu el, Ta el; Cu-TaN int, TaN int, Cu int, Ta int, N int, TaN bin, Ta bin, N bin, Cu el; AlCu int, Al int, Cu int, AlCu bin, Al bin, Cu bin; H2O2 bin, H2 bin, O2 bin, H bin, O bin; SiO2 bin, O2 bin, Si bin, O bin; Al2O3 bin, Al2 bin, Al bin, O3 bin, O bin

ET Cu; Ta; As; Al; N*Ta; TaN; Ta cp; cp; N cp; Cu*Ta; Cu sy 2; sy 2; Ta sy 2; Cu-Ta; Cu*N*Ta; Cu sy 3; sy 3; N sy 3; Ta sy 3; Cu-TaN; Al*Cu; Al sy 2; AlCu; Al cp; Cu cp; H*O; H2O2; H cp; O cp; O*Si; SiO2; Si cp; Al*O; Al2O3; H2O; H; O; SiO; Si; Al2O

L32 ANSWER 4 OF 12 INSPEC COPYRIGHT 2001 IEE
 AN 2001:7015278 INSPEC DN B2001-10-2550F-009
 TI Development of a **slurry** employing a unique silica abrasive for the **CMP** of Cu damascene structures.
 AU Wrschka, P. (Dept. of Phys., Univ. of Albany, NY, USA); Hernandez, J.; Oehrlein, G.S.; Negrych, J.A.; Haag, G.; Rau, P.; Currie, J.E.
 SO Journal of the Electrochemical Society (June 2001) vol.148, no.6, p.G321-5. 27 refs.
 Doc. No.: S0013-4651(01)04106-4
 Published by: Electrochem. Soc
 Price: CCCC 0013-4651/2001/148(6)/321/5/\$7.00
 CODEN: JESOAN ISSN: 0013-4651
 SICI: 0013-4651(200106)148:6L.g321:DSEU;1-5
 DT Journal
 TC Application; Experimental
 CY United States

LA English
 AB We describe the development and examine the performance of a **slurry** containing an organic acid salt, a silica abrasive obtained from the hydrolysis of ethyl silicate (TEOS), and a passivating agent for the chemical mechanical planarization (**CMP**) of Cu damascene structures. The study is performed on full (200 mm) wafers coated with blanket Cu films to examine removal rates and uniformity and on partial wafers to investigate the **CMP** of Cu damascene structures. The silica **slurry** shows moderately high removal rates, good uniformity values, low defectivity, and excellent ability to remove the **Ta** liner. It is demonstrated that despite the fairly low Cu to SiO₂ selectivity values, a severe erosion of the SiO₂ does not occur. Because of the effective removal of the liner material, long overpolishing times become unnecessary, thus, spacer erosion is avoided. Corrosion induced defects are prevented by the addition of a passivating agent.

CC B2550F Metallisation and interconnection technology; B2550E Surface treatment (semiconductor technology)

CT **CHEMICAL MECHANICAL POLISHING; COPPER; INTEGRATED CIRCUIT INTERCONNECTIONS; INTEGRATED CIRCUIT METALLISATION; PASSIVATION**

ST **slurry**; silica abrasive; **CMP**; Cu damascene structures; organic acid salt; hydrolysis; ethyl silicate; TEOS; passivating agent; chemical mechanical planarization; blanket Cu films; partial wafers; removal rates; uniformity values; **Ta liner**; erosion; overpolishing times; corrosion induced defects; Cu; SiO₂

CHI Cu sur, Cu el; Cu int, Cu el; SiO₂ bin, O₂ bin, Si bin, O bin

ET Cu; Ta; O*Si; SiO₂; Si cp; cp; O cp; SiO; O; Si

L32 ANSWER 5 OF 12 INSPEC COPYRIGHT 2001 IEE

AN 2000:6721785 INSPEC DN B2000-11-2550F-012

TI Role of film hardness on the polish rates of metal thin films.

AU Ramarajan, S. (Dept. of Chem. Eng., Clarkson Univ., Potsdam, NY, USA); Li, Y.; Hariharaputhiran, M.; Her, Y.S.; Babu, S.V.

SO Chemical-Mechanical Polishing - Fundamentals and Challenges. Symposium (Materials Research Society Symposium Proceedings Vol.566)
 Editor(s): Babu, S.V.; Danyluk, S.; Krishnan, M.; Tsujimura, M.
 Warrendale, PA, USA: Mater. Res. Soc, 2000. p.123-8 of ix+281 pp. 9 refs.
 Conference: San Francisco, CA, USA, 5-7 April 1999
 ISBN: 1-55899-473-4

DT Conference Article

TC Practical; Experimental

CY United States

LA English

AB Nanoindentation techniques were used to determine the hardness of Cu, **Ta** and W metal discs and thin films on silicon substrates as a function of load or indentation depth. Cu films exposed to oxidizing solutions containing H₂O₂ exhibited a higher hardness at the surface while no such change was observed for W exposed to ferric nitrate. The implication of these measurements and their relationship to **chemical-mechanical polishing** rates are discussed.

CC B2550F Metallisation and interconnection technology; B2550E Surface treatment (semiconductor technology); B2550N Nanometre-scale semiconductor fabrication technology; B2570 Semiconductor integrated circuits; B0530 Metals and alloys (engineering materials science)

CT **CHEMICAL MECHANICAL POLISHING; COPPER; HARDNESS; INDENTATION; INTEGRATED CIRCUIT INTERCONNECTIONS; INTEGRATED CIRCUIT MEASUREMENT; INTEGRATED CIRCUIT METALLISATION; METALLIC THIN FILMS; NANOTECHNOLOGY; OXIDATION; TANTALUM; TUNGSTEN**

ST film hardness; polish rates; metal thin films; nanoindentation techniques; Cu hardness; **Ta hardness**; W hardness; Cu metal discs; **Ta**

metal discs; W metal discs; Cu metal thin films; **Ta metal thin films**; W metal thin films; silicon substrates; indentation depth; Cu films; oxidizing solutions; **oxidizing solution H2O2 content**; surface hardness; ferric nitrate exposure; **chemical-mechanical polishing rates**; Cu; **Ta**; W; H2O2; Si

CHI Cu sur, Cu el; Ta sur, Ta el; W sur, W el; H2O2 bin, H2 bin, O2 bin, H bin, O bin; Si sur, Si el

ET Cu; Ta; W; H*O; H2O2; H cp; cp; O cp; Si; H2O; H; O

L32 ANSWER 6 OF 12 INSPEC COPYRIGHT 2001 IEE

AN 2000:6579209 INSPEC DN A2000-11-8160B-052; B2000-06-2550F-026

TI Effect of pH and ionic strength on **chemical mechanical polishing of tantalum**.

AU Ramarajan, S. (Dept. of Chem. Eng., Clarkson Univ., Potsdam, NY, USA); Li, Y.; Hariharaputhiran, M.; Her, Y.-S.; Babu, S.V.

SO Electrochemical and Solid-State Letters (May 2000) vol.3, no.5, p.232-4. 19 refs.

Published by: Electrochem. Soc

CODEN: ESLEF6 ISSN: 1099-0062

SICI: 1099-0062(200005)3:5L.232:EISC;1-9

DT Journal

TC Experimental

CY United States

LA English

AB **Chemical mechanical polishing of tantalum** was performed using alumina and silica particles dispersed in deionized water as a function of pH and ionic strength. The highest polish rate was obtained at pH values of 3.5 and 8.0 in silica and alumina **slurries**, respectively. The variation in the polish rate with pH is due primarily to variations in electrostatic interactions between the particles and the **tantalum** surface and the effect of changes in average particle size appears to be small. This is confirmed by the measured changes in **tantalum** polish rate due to changes in ionic strength of the **slurry**.

CC A8160B Surface treatment and degradation of metals and alloys; A8160C Surface treatment and degradation in semiconductor technology; B2550F Metallisation and interconnection technology; B2550E Surface treatment (semiconductor technology); B2570 Semiconductor integrated circuits

CT **CHEMICAL MECHANICAL POLISHING; INTEGRATED CIRCUIT INTERCONNECTIONS; PARTICLE SIZE; TANTALUM**

ST **chemical mechanical polishing**; ionic strength; pH; silica particles; alumina particles; deionized water; polish rate; electrostatic interactions; particle size; **Ta**; Al2O3; SiO2

CHI Ta sur, Ta el; Al2O3 sur, Al2 sur, Al sur, O3 sur, O sur, Al2O3 bin, Al2 bin, Al bin, O3 bin, O bin; SiO2 sur, O2 sur, Si sur, O sur, SiO2 bin, O2 bin, Si bin, O bin

ET Ta; Al*O; Al2O3; Al cp; cp; O cp; O*Si; SiO2; Si cp; Al2O; Al; O; SiO; Si

L32 ANSWER 7 OF 12 INSPEC COPYRIGHT 2001 IEE

AN 1999:6370915 INSPEC DN B1999-11-2550F-013

TI A cautious approach to the removal of **Ta** in the **CMP** polishing of Cu/**Ta** structures.

AU Brusic, V.; Kistler, R.; Wang, S.; Hawkins, J.; Schmidt, C. (Div. of Microelectron. Mater., Cabot Corp., Aurora, IL, USA)

SO Proceedings of the Second International Symposium on Chemical Mechanical Planarization in Integrated Circuit Device Manufacturing

Editor(s): Raghavan, S.; Opila, R.L.; Zhang, L.

Pennington, NJ, USA: Electrochem. Soc, 1998. p.119-25 of vii+274 pp. 4 refs.

Conference: San Diego, CA, USA, 5-7 May 1998

ISBN: 1-56677-201-X

DT Conference Article
 TC Practical; Experimental
 CY United States
 LA English
 AB This work examines the electrochemical behavior of **Ta** in a variety of electrolytes with varying pH, with and without oxidizers, complexing agents and inhibitors, as well as in actual polishing **slurries**. Tests are conducted under static and dynamic conditions, with and without surface abrasion. Results are utilized to evaluate the most important factors determining the rate of **Ta** dissolution, the applicable polishing mechanism, and the selection of a single or two-step approach in **chemical mechanical polishing** of **Cu-Ta** structures.

CC B2550F Metallisation and interconnection technology; B2550E Surface treatment (semiconductor technology); B0170E Production facilities and engineering; B2570A Semiconductor integrated circuit design, layout, modelling and testing

CT ABRASION; **CHEMICAL MECHANICAL POLISHING**; COPPER; DISSOLVING; ELECTROCHEMISTRY; ELECTROLYTES; INTEGRATED CIRCUIT INTERCONNECTIONS; INTEGRATED CIRCUIT METALLISATION; INTEGRATED CIRCUIT TESTING; OXIDATION; **TANTALUM**

ST **Ta removal**; **CMP**; polishing; **Cu-Ta structures**; **Ta electrochemical behavior**; electrolytes; oxidizers; complexing agents; inhibitors; **polishing slurries**; dynamic test conditions; static test conditions; surface abrasion; **Ta dissolution rate**; polishing mechanism; **chemical mechanical polishing**; **Cu-Ta**

CHI Cu-Ta int, Cu int, Ta int, Cu el, Ta el
 ET Ta; Cu; Cu-Ta; Cu sy 2; sy 2; Ta sy 2; Cu-Ta

L32 ANSWER 8 OF 12 INSPEC COPYRIGHT 2001 IEE
 AN 1999:6301768 INSPEC DN B1999-09-2550F-001
 TI Investigating **CMP** and post-**CMP** cleaning issues for dual-damascene copper technology.
 AU Peterson, M.L.; Small, R.J.; Shaw, G.A., III; Chen, Z.J.; Truong, T. (EKC Technol., Hayward, CA, USA)
 SO Micro (Jan. 1999) vol.17, no.1, p.27-32, 34. 12 refs.
 Published by: Canon Communications
 CODEN: MICRFI ISSN: 1081-0595
 SICI: 1081-0595(199901)17:1L:27:IPCI;1-W

DT Journal
 TC Practical; Experimental
 CY United States
 LA English
 AB The impending transition from aluminum metallization to dual-damascene copper technology presents a number of challenges in the areas of **CMP** and post-**CMP** cleaning. Copper's low resistivity allows for increased line density, but its tendency to diffuse into silicon and oxide makes the use of barrier materials such as **tantalum** a necessity. Novel oxidizer chemistries used in a two-step **CMP** process have shown excellent potential for equalizing the **CMP** removal rates of copper and **tantalum**, thereby minimizing the dishing problems typically associated with copper planarization. The electrochemical techniques described here explain this behaviour. Following **CMP**, both residual **slurry** particles and metals must be removed from the **wafer** surface to prevent device failure. A post-**CMP** cleaning chemistry that modifies the surface charge potential of **slurry** particles and incorporates chelators to stabilize residual metals in **solution** can help achieve both goals. The use of such an effective cleaning chemistry may also help minimize process time and water usage.

CC B2550F Metallisation and interconnection technology; B2550E Surface treatment (semiconductor technology); B0170E Production facilities and engineering; B2570 Semiconductor integrated circuits; B2530D Semiconductor-metal interfaces

CT CHEMICAL INTERDIFFUSION; **CHEMICAL MECHANICAL POLISHING**; COPPER; DIFFUSION BARRIERS; ELECTRICAL RESISTIVITY; ELECTROCHEMISTRY; INTEGRATED **CIRCUIT** INTERCONNECTIONS; INTEGRATED **CIRCUIT** METALLISATION; SURFACE CLEANING; SURFACE CONTAMINATION

ST **CMP**; **post-CMP cleaning**; dual-damascene copper technology; aluminum metallization; resistivity; line density; Cu diffusion tendency; barrier materials; **tantalum barrier materials**; oxidizer chemistries; **two-step CMP process**; **CMP removal rate equalization**; dishing; copper planarization; electrochemical techniques; **residual slurry particle contamination**; metal contamination; **wafer surface**; device failure; **post-CMP cleaning chemistry**; surface charge potential; **slurry particles**; chelators; **residual metal solution stabilization**; cleaning chemistry; process time; water usage; **Cu-Ta-SiO₂-Si**

CHI Cu-Ta-SiO₂-Si int, SiO₂ int, Cu int, O₂ int, Si int, Ta int, O int, SiO₂ bin, O₂ bin, Si bin, O bin, Cu el, Si el, Ta el

ET Cu; Cu*O*Si*Ta; Cu sy 4; sy 4; O sy 4; Si sy 4; Ta sy 4; SiO₂; Si cp; cp; O cp; Cu-Ta-SiO₂-Si; SiO; Cu-Ta-SiO; Si; O*Si; O; Ta

* L32 ANSWER 9 OF 12 INSPEC COPYRIGHT 2001 IEE

AN 1999:6239939 INSPEC DN B1999-06-2550E-067

TI Development of a production worthy copper **CMP** process.

AU Wijekoon, K.; Mishra, S.; Tsai, S.; Puntambekar, K.; Chandrachood, M.; Redeker, F.; Tolles, R. (Div. of CMP, Appl. Mater. Inc., Santa Clara, CA, USA); Sun, B.; Chen, L.; Pan, T.; Li, P.; Nanjangud, S.; Amico, G.; Hawkins, J.; Myers, T.; Kistler, R.; Brusich, V.; Wang, S.; Cherian, I.; Knowles, L.; Schmidt, C.; Baker, C.

SO IEEE/SEMI 1998 IEEE/SEMI Advanced Semiconductor Manufacturing Conference and Workshop (Cat. No.98CH36168)
New York, NY, USA: IEEE, 1998. p.354-63 of vi+482 pp. 11 refs.
Conference: Boston, MA, USA, 23-25 Sept 1998
Sponsor(s): Semicond. Equipment & Mater. Int. (SEMI); IEEE; IEEE Electron Devices Soc.; IEEE Components, Packaging & Manuf. Technol. Soc
Price: CCCC 0 7803 4380 8/98/\$10.00
ISBN: 0-7803-4380-8

DT Conference Article

TC Practical; Experimental

CY United States

LA English

AB A **chemical mechanical polishing (CMP)** process for copper damascene structures has been developed and characterized on a second generation, multiple **platen** polishing tool. Several formulations of experimental copper **slurries** containing alumina abrasive particles were evaluated for their selectivity of copper to **Ta**, **TaN** and **PETEOS** films. The extent of copper dishing and oxide erosion of these **slurries** is investigated with various process parameters such as **slurry** flow rate, **platen** speed and **wafer** pressure. The amount of dishing and erosion is found to be largely dependent on process parameters as well as the **slurry** composition. It is shown that the extent of oxide erosion and copper dishing can be significantly reduced by using a two **slurry** copper polish process (one **slurry** to polish copper and another to polish barrier layers) in conjunction with an optical end-point detection system.

CC B2550E Surface treatment (semiconductor technology); B2550F Metallisation and interconnection technology; B2570A Semiconductor integrated circuit design, layout, modelling and testing

CT ABRASION; **CHEMICAL MECHANICAL POLISHING**; COPPER;
 INTEGRATED **CIRCUIT** INTERCONNECTIONS; INTEGRATED **CIRCUIT**
 METALLISATION; INTEGRATED **CIRCUIT** TESTING; SURFACE CHEMISTRY;
 SURFACE TOPOGRAPHY

ST **copper CMP process development; chemical mechanical**
polishing; CMP process; copper damascene structures;
multiple platen polishing tool; copper slurries; alumina
 abrasive particles; Cu selectivity; PETEOS films; TaN films; **Ta**
films; copper dishing; oxide erosion; process parameters; slurry
flow rate; platen speed; wafer pressure;
slurry composition; two slurry copper polish process;
copper polish slurry; barrier layer polish slurry;
 optical end-point detection system; Cu; TaN; **Ta**; SiO₂; Al₂O₃;
 Cu-Ta; Cu-TaN

CHI Cu sur, Cu el; TaN sur, Ta sur, N sur, TaN bin, Ta bin, N bin; Ta sur, Ta
 el; SiO₂ sur, O₂ sur, Si sur, O sur, SiO₂ bin, O₂ bin, Si bin, O bin;
 Al₂O₃ bin, Al₂ bin, Al bin, O₃ bin, O bin; Cu-Ta int, Cu int, Ta int, Cu
 el, Ta el; Cu-TaN int, TaN int, Cu int, Ta int, N int, TaN bin, Ta bin, N
 bin, Cu el

ET Ta; N-Ta; TaN; Ta cp; cp; N cp; Cu; O-Si; SiO₂; Si cp; O cp; Al*O; Al₂O₃;
 Al cp; Cu-Ta; Cu sy 2; sy 2; Ta sy 2; Cu-Ta; Cu*N-Ta; Cu sy 3; sy 3; N sy
 3; Ta sy 3; Cu-TaN; N; SiO; O; Si; Al₂O; Al

L32 ANSWER 10 OF 12 INSPEC COPYRIGHT 2001 FIZ KARLSRUHE
 AN 1998:5869055 INSPEC DN B9805-2550F-010
 TI Damascene copper interconnects with polymer ILDs.
 AU Price, D.T.; Gutmann, R.J.; Murarka, S.P. (Center for Integrated
 Electron., Rensselaer Polytech. Inst., Troy, NY, USA)
 SO Thin Solid Films (31 Oct. 1997) vol.308-309, p.523-8. 9 refs.
 Doc. No.: S0040-6090(97)00479-3
 Published by: Elsevier
 Price: CCCC 0040-6090/97/\$17.00
 CODEN: THSFAP ISSN: 0040-6090
 SICI: 0040-6090(19971031)308/309L:523:DCIW;1-F
 Conference: 24th International Conference on Metallurgical Coatings and
 Thin Films. San Diego, CA, USA, 21-25 April 1997

DT Conference Article; Journal
 TC Experimental
 CY Switzerland
 LA English

AB On-chip interconnects with copper metallization and polymer interlevel
 dielectrics (ILDs) have the lowest R-C delay, lowest parasitic coupling
 and highest electromigration resistance of currently proposed room
 temperature material sets. Patterning of such interconnect structures
 requires either damascene patterning (chemical-mechanical planarization (**CMP**)
 of copper deposited into trenches and vias RIE into the
 polymer) or elevated temperature RIE patterning of the copper. In this
 paper we present the dual damascene patterning of copper on low dielectric
 constant polymers like divinylsiloxane bisbenzocyclobutene (DVS bis BCB)
 and parylene-n. In particular, we present and discuss various RIE polymer
 etch masks and **CMP** polish stops that have been utilized in this
 work (such as PECVD silicon nitride, PECVD silicon dioxide and
tantalum) and the results with different pads and **slurries**
 . Emphasis is placed on achieving a planar copper **CMP** with a
 minimum amount of polish stop and polymer ILD erosion, as well as
 attaining low contact resistance. Difficulties in achieving these
 desirable features with relatively soft low dielectric constant polymers
 are presented, with contact resistivity in the mid 10⁻⁹ Omega -cm² having
 been achieved to date.

CC B2550F Metallisation and interconnection technology; B2550E Surface
 treatment for semiconductor devices; B2550G Lithography; B2810 Dielectric

materials and properties

CT CONTACT RESISTANCE; COPPER; DIELECTRIC THIN FILMS; ELECTROMIGRATION; EROSION; IMPURITY DISTRIBUTION; INTEGRATED **CIRCUIT** INTERCONNECTIONS; INTEGRATED **CIRCUIT** METALLISATION; MASKS; METALLIC THIN FILMS; PHOTOLITHOGRAPHY; POLYMER FILMS; SPECTROCHEMICAL ANALYSIS; SPUTTER ETCHING; SURFACE CLEANING; X-RAY PHOTOELECTRON SPECTRA

ST on-chip interconnects; copper metallization; polymer interlevel dielectrics; parasitic coupling; electromigration resistance; damascene patterning; chemical-mechanical planarization; RIE patterning; reactive ion etching patterning; dielectric constant; contact resistance; ILD erosion; XPS; X-ray photoelectron spectroscopy; Cu

CHI Cu sur, Cu el

ET Cu

L32 ANSWER 11 OF 12 INSPEC COPYRIGHT 2001 FIZ KARLSRUHE

AN 1997:5782816 INSPEC DN A9803-8160B-003; B9802-0520F-014

TI **Chemical mechanical polishing** for selective CVD-W.

AU Wang, M.T.; Yeh, W.K. (Dept. of Electron. Eng., Nat. Chiao Tung Univ., Hsinchu, Taiwan); Tsai, M.S.; Tseng, W.T.; Chang, T.C.; Chen, L.J.; Chen, M.C.

SO Materials Chemistry and Physics (30 Oct. 1997) vol.51, no.1, p.75-9. 11 refs.
Published by: Elsevier
Price: CCCC 0254-0584/97/\$17.00
CODEN: MCHPDR ISSN: 0254-0584
SICI: 0254-0584(19971030)51:1L.75:CMPS;1-L

DT Journal

TC Experimental

CY Switzerland

LA English

AB This work investigates **chemical mechanical polishing** (**CMP**) for W-filled contact holes, vias, and trenches by selective chemical vapor deposition. A novel process that combines the **CMP** technique with selective chemical vapor deposition of tungsten (CVD-W) was employed to remove nail heads due to overgrowth and W-particles on the surface of dielectric due to selectivity loss. The overfilled nail heads and the selectivity loss can be completely removed with very low down-pressure (3 psi) in a very short polishing time (30 s). This indicates that the novel process is very promising for ULSI multilevel interconnection application. The removal rate selectivities of W to thermal oxide, PECVD-TEOS, and BPSG were found to be 47:1, 30:1 and 15:1, respectively, while the selectivities of W to the barrier metals of TiW, Ti and Ta were determined to be 0.6:1, 6:1 and 28:1, respectively.

CC A8160B Surface treatment and degradation of metals and alloys; A6820 Solid surface structure; A8115H Chemical vapour deposition; B0520F Vapour deposition; B2550F Metallisation and interconnection technology; B2550E Surface treatment for semiconductor devices

CT CHEMICAL VAPOUR DEPOSITION; CORROSION; CVD COATINGS; ELECTRICAL RESISTIVITY; ETCHING; INTEGRATED **CIRCUIT** METALLISATION; METALLIC THIN FILMS; OHMIC CONTACTS; POLISHING; POLYMORPHISM; SCANNING ELECTRON MICROSCOPY; SURFACE TOPOGRAPHY; TUNGSTEN; ULSI; X-RAY DIFFRACTION

ST **chemical mechanical polishing**; W-filled contact holes,; W-filled vias; filled trenches; selective W-chemical vapor deposition; **CMP selective CVD W-combination**; **CMP selective chemical vapour deposition W-combination**; nail heads removal; W-overgrowth; W-particles removal; dielectric substrate; polishing time; ULSI application; removal rate selectivities; W-barrier metal selectivity; **polishing slurry**; **slurry general specifications**; **CMP parameters**; electrical resistivity; XRD; X-ray diffraction; SEM; scanning electron microscopy; surface topography; surface cleaning;

corrosion; W

CHI W el

ET W; Ti*W; Ti sy 2; sy 2; W sy 2; TiW; Ti cp; cp; W cp; Ti; Ta

L32 ANSWER 12 OF 12 INSPEC COPYRIGHT 2001 IEE

AN 1997:5678054 INSPEC DN B9710-2550F-026

TI Electrochemical interaction between copper and barrier materials during **chemical mechanical polishing**.

AU Evans, D.R. (Sharp Microelectron. Technol., Camas, WA, USA)

SO Proceedings of the First International Symposium on Chemical Mechanical Planarization

Editor(s): Ali, I.; Raghavan, S.

Pennington, NJ, USA: Electrochem. Soc, 1997. p.70-8 of ix+275 pp. 6 refs.

Conference: San Antonio, TX, USA, Oct 1996

DT Conference Article

TC Practical; Experimental

CY United States

LA English

AB In this work, cell potentials are observed between copper and barrier materials in simultaneous contact with the chemical component of the **slurry**, i.e. inert solids were removed from the **slurry**. For titanium nitride, these potentials are found to vary systematically as a function of barrier metal composition and **slurry**/hydrogen peroxide mixture. In contrast, for a fixed **slurry** composition, cell potentials between **tantalum/tantalum** nitride or titanium-tungsten/titanium-tungsten nitride are relatively insensitive to nitrogen content.

CC B2550F Metallisation and interconnection technology; B2530D Semiconductor-metal interfaces; B2570 Semiconductor integrated circuits; B2550E Surface treatment for semiconductor devices

CT CHEMICAL INTERDIFFUSION; COPPER; DIFFUSION BARRIERS; ELECTRIC POTENTIAL; INTEGRATED **CIRCUIT** INTERCONNECTIONS; INTEGRATED **CIRCUIT** METALLISATION; POLISHING

ST electrochemical interaction; copper; barrier materials; **chemical mechanical polishing**; cell potentials; **slurry chemical component**; inert solids; titanium nitride; barrier metal composition; **slurry/hydrogen peroxide mixture**; **slurry composition**; **tantalum/tantalum nitride**; titanium-tungsten; titanium-tungsten nitride; nitrogen content; Cu-TiN; H2O2; **Ta-TaN**; Ti-W; Ti-WN; N

CHI Cu-TiN int, TiN int, Cu int, Ti int, N int, TiN bin, Ti bin, N bin, Cu el; H2O2 bin, H2 bin, O2 bin, H bin, O bin; Ta-TaN int, TaN int, Ta int, N int, TaN bin, Ta bin, N bin, Ta el; Ti-W int, Ti int, W int, Ti el, W el; Ti-WN int, Ti int, WN int, N int, W int, WN bin, N bin, W bin, Ti el; N el

ET In; Cu*N*Ti; Cu sy 3; sy 3; N sy 3; Ti sy 3; TiN; Ti cp; cp; N cp; Cu-TiN; H*O; H2O2; H cp; O cp; N*Ta; N sy 2; sy 2; Ta sy 2; TaN; Ta cp; Ta-TaN; Ti*W; Ti sy 2; W sy 2; Ti-W; N*Ti*W; W sy 3; WN; W cp; Ti-WN; N; N*Ti; Cu; Ti; H2O; H; O; Ta

L4 22862 SEA FILE=WPIX 1,2,4-TRIAZOLE OR BENZOTRIAZOLE OR IMIDAZOLE OR
5-METHYLBENZIMIDAZOLE OR POLYANILINE OR INDIAZOLE OR PURINE OR
BTA
L5 22270 SEA FILE=WPIX PVA OR PAA OR GEO OR GPO OR DCA OR PEI OR
DMSIO-EO
L6 269703 SEA FILE=WPIX POLYVINYL ALCOHOL OR VINYL ACETATE OR POLYETHYLEN
E OR SORBITOL OR GLYCEROL OR POLYACRYLAMIDE OR ETHYLENE GLYCOL
OR GLYCEROL ETHOXYLATE OR DIMETHYLSILOXANE ETHYLENE OXIDE OR
POLYETHYLENE OXIDE OR POLYOXYETHYLENE OR GLYCEROL PROPOXYLATE
OR ?HEXYLAMINE OR POLYETHYLENEIMINE
L9 29624 SEA FILE=WPIX TA OR TANTALUM
L29 2788 SEA FILE=INSPEC CMP OR CHEM?(3A)POLISH?
L33 342 SEA FILE=IFIPAT L4 (S) (L5 OR L6)
L34 30 SEA FILE=IFIPAT L9 (S) L29
L36 11 SEA FILE=IFIPAT (L33 OR SOLUTION OR SLURR?) (L) L34

=> d bib, kwic 1-

YOU HAVE REQUESTED DATA FROM 11 ANSWERS - CONTINUE? Y/(N):y

L36 ANSWER 1 OF 11 IFIPAT COPYRIGHT 2001 IFI
AN 3494380 IFIPAT;IFIUDB;IFICDB
TI **CHEMICAL MECHANICAL POLISHING SLURRY** USEFUL
FOR COPPER/**TANTALUM** SUBSTRATES; ABRASIVE, OXIDIZER, ACETIC
ACID, AND FILM FORMING AGENT; INTEGRATED CIRCUITS; SEMICONDUCTORS;
WAFERS; THIN FILMS
INF Kaufman; Vlasta Brusic, Geneva, IL
Kistler; Rodney C., St. Charles, IL
Wang; Shumin, Naperville, IL
IN Kaufman Vlasta Brusic; Kistler Rodney C; Wang Shumin
PAF Cabot Microelectronics Corporation, Aurora, IL
PA Cabot Microelectronics Corp (54695)
EXNAM Wellington, A. L
EXNAM Hong, William
PI US 6217416 20010417
AI US 1998-105065 19980626
XPD 26 Jun 2018
FI US 6217416 20010417
DT UTILITY
FS CHEMICAL MECHANICAL
CHEMICAL
MECHANICAL
CLMN 11
TI **CHEMICAL MECHANICAL POLISHING SLURRY** USEFUL
FOR COPPER/**TANTALUM** SUBSTRATES; ABRASIVE, OXIDIZER, ACETIC
ACID, AND FILM FORMING AGENT; INTEGRATED CIRCUITS; SEMICONDUCTORS;
WAFERS; THIN FILMS
AB The present invention is a first **CMP slurry** including
an abrasive, an oxidizing agent, a complexing agent, a film forming agent
and an organic amino compound, a second polishing **slurry**
including an abrasive, an oxidizing agent, and acetic acid wherein the
weight ratio of the oxidizing agent to acetic acid is at least 10 and a
method for using the first and second polishing **slurries**
sequentially to polish a substrate containing copper and containing
tantalum or **tantalum** nitride or both **tantalum**
and **tantalum** nitride.
L36 ANSWER 2 OF 11 IFIPAT COPYRIGHT 2001 IFI
AN 3478978 IFIPAT;IFIUDB;IFICDB
TI CHEMICAL MECHANICAL POLISHING TOOL COMPONENTS WITH IMPROVED CORROSION
RESISTANCE

INF Dyer; Timothy S., Tempe, AZ
 Stumpf; John F., Phoenix, AZ
 IN Dyer Timothy S; Stumpf John F
 PAF SpeedFam-IPEC Corporation, Chandler, AZ
 PA SpeedFam-IPEC Corp (50939)
 EXNAM Banks, Derris H
 AG Snell & Wilmer LLP
 PI US 6203417 20010320
 AI US 1999-434650 19991105
 XPD 5 Nov 2019
 FI US 6203417 20010320
 DT UTILITY
 FS MECHANICAL
 CLMN 10
 GI 2 Drawing Sheet(s), 3 Figure(s).
 ECLM . . . the carrier facing the pad to facilitate polishing a wafer held
 in the carrier against the pad with a chemical **slurry**, the
 improvement comprising: the platen having a tightly adhered, self
 repairing coating on surfaces exposed to the **slurry**, the
 coating resistant to chemical reaction with the chemical **slurry**
 .
 ACLM . . . the carrier facing the pad to facilitate polishing a wafer held
 in the carrier against the pad with a chemical **slurry**, the
 improvement comprising: the platen having a self repairing, machinable,
 tightly adhered coating on surfaces exposed to the **slurry**, the
 coating resistant to reaction with the chemical **slurry**.
 3. An improvement in a chemical mechanical polishing apparatus, the
 apparatus comprising components exposed to contact with a chemical
slurry, the improvement comprising: at least some of the
 components having a self repairing coating resistant to chemical reaction
 with the chemical **slurry**.
 . . . is at least partially covered by a sealant layer formed of a
 polymeric composition resistant to chemical attack by the **slurry**
 .
 10. A chemical mechanical polishing apparatus
 comprising: (a) a carrier for holding a wafer to be polished; (b) means
 for supplying **slurry** to a wafer surface when the wafer is in
 the carrier undergoing polishing; and (c) components of the apparatus
 exposed to chemical **slurry** when the apparatus is in use, at
 least some of the components comprising a coating over at least surfaces
 exposed to the **slurry** during use of the apparatus wherein the
 coating is self resistant to chemical attack by the **slurry** and
 wherein the coating is selected from the group consisting of the coatings
 of the general formula: M1 C-M2 -M3, where: M1 C is selected from W,
Ta, Zr, Ti and Nb; M2 is selected from Ni, Cr, Mn; and M3 is
 selected from Co and Fe.

L36 ANSWER 3 OF 11 IFIPAT COPYRIGHT 2001 IFI
 AN 3472511 IFIPAT;IFIUDB;IFICDB
 TI CHEMICALLY PREVENTING CU DENDRITE FORMATION AND GROWTH BY DOUBLE SIDED
 SCRUBBING; FORMING COPPER (CU) OR CU ALLOY INTERCONNECTION PATTERN
 COMPRISING DENSE ARRAY OF SPACED APART CU OR CU ALLOY LINES BORDERING
 OPEN DIELECTRIC FILLED ON SURFACE OF WAFER; CHEMICALLY TREATING SURFACE BY
 DOUBLE SIDED BRUSH SCRUBBLING
 INF Avanzino; Steven C., Cupertino, CA
 Schonauer; Diana M., San Jose, CA
 Yang; Kai, Fremont, CA
 IN Avanzino Steven C; Schonauer Diana M; Yang Kai
 PAF Advanced Micro Devices, Inc., Sunnyvale, CA
 PA Advanced Micro Devices Inc (1075)
 EXNAM Everhart, Caridad

PI US 6197690 20010306
 AI US 1998-205021 19981204
 XPD 4 Dec 2018
 FI US 6197690 20010306
 DT UTILITY
 FS CHEMICAL
 CLMN 30
 GI 1 Drawing Sheet(s), 1 Figure(s).
 ACLM 2. The method according to claim 1, wherein the chemical agent comprises a **solution** containing ammonium fluoride, diammonium hydrogen citrate, triammonium citrate, and de-ionized water.
 3. The method according to claim 2, wherein the **solution** further comprises a surfactant.
 9. The method according to claim 2, comprising double sided scrubbing the wafer in tile **solution** for about 30 to about 180 seconds.
 10. The method according to claim 8, comprising double sided scrubbing the wafer in a **solution** containing: about 8.5 to less than about 10 wt. % diammonium hydrogen citrate; about 6.5 to less than about 10.
 12. The method according to claim 8, comprising: forming trenches in the silicon oxide layer; depositing a barrier layer, comprising **tantalum** or **tantalum** nitride, lining the trenches and on the silicon oxide layer; depositing a cu or a cu alloy layer on the barrier layer filling the trenches; **chemical** mechanical **polishing** to substantially remove the barrier layer; double sided brush scrubbing the wafer with the **solution**; and double sided brush scrubbing the wafer with water before or after double sided brush scrubbing the wafer with the **solution**.
 18. The method according to claim 17, wherein the chemical agent is a **solution** containing ammonium fluoride, diammonium hydrogen citrate, triammonium citrate, a surfactant and water with a chemical agent with or without a.
 21. The method according to claim 1, wherein the chemical agent comprises a **solution** of hydrofluoric acid, de-ionized water and a surfactant.
 22. The method according to claim 1, wherein the chemical agent comprises a **solution** of ammonium fluoride, hydrofluoric acid and de-ionized water.
 23. The method according to claim 1, wherein the chemical agent comprises a **solution** of acetic acid and ammonium fluoride.

L36 ANSWER 4 OF 11 IFIPAT COPYRIGHT 2001 IFI
 AN 3346932 IFIPAT;IFIUDB;IFICDB
 TI SLURRY COMPOSITIONS AND METHOD FOR THE CHEMICAL-MECHANICAL POLISHING OF COPPER AND COPPER ALLOYS; FOR POLISHING A COPPER COATED WAFER CONTAINING A COPPER ADHESION-PROMOTING LAYER AND A SILICON-BASED LAYER
 INF Mahulikar; Deepak, Madison, CT
 Mravic deceased; Brian, late of New Haven, CT
 Pasqualoni; Anthony Mark, Hamden, CT
 IN Mahulikar Deepak; Mravic Brian deceased; Pasqualoni Anthony Mark
 PAF Arch Specialty Chemicals, Inc., Norwalk, CT
 PA Arch Specialty Chemicals Inc (53083)
 EXNAM Powell, William
 AG Ohlandt, Greeley, Ruggiero & Perle, L.L.P.
 PI US 6083840 20000704
 AI US 1998-200518 19981125
 PRAI US 1998-77071 19980306 (Provisional)
 US 1997-66800 19971126 (Provisional)
 FI US 6083840 20000704
 DT UTILITY
 FS CHEMICAL

OS CA 133:82711
 MRN 009867 MFN: 0784
 009874 0228
 CLMN 28
 GI 2 Drawing Sheet(s), 4 Figure(s).
 AB The present invention relates to an improved **chemical**
-mechanical polishing (CMP) method for polishing a
 copper coated wafer containing a copper adhesion-promoting layer and a
 silicon-based layer. The method polishes copper. . . dishing and
 erosion. The method involves a two step process. The first step is to
 utilize a bulk copper removal **slurry** that rapidly removes the
 majority the copper on the substrate. The second step utilizes a 1:1:1
 selectivity copper/**tantalum**/silicon dioxide (Cu/**Ta**
 /SiO₂) **slurry** that has approximately the same polishing rates
 for the copper layer, the adhesion-promoting layer and the silicon-based
 substrate. The second **slurry** reduces the amount of dishing and
 erosion that occurs in the copper trenches and dense copper arrays.

L36 ANSWER 5 OF 11 IFIPAT COPYRIGHT 2001 IFI

AN 3323821 IFIPAT;IFIUDB;IFICDB

TI **CHEMICAL MECHANICAL POLISHING SLURRY USEFUL**
 FOR COPPER/**TANTALUM** SUBSTRATE; ABRASIVE, AMINO COMPOUND AND
 COMPLEXING AGENT

INF Kaufman; Vlasta Brusic, Geneva, IL
 Kistler; Rodney C., St. Charles, IL
 Wang; Shumin, Naperville, IL

IN Kaufman Vlasta Brusic; Kistler Rodney C; Wang Shumin

PAF Cabot Corporation, Boston, MA

PA Cabot Corp (13064)

EXNAM Powell, William

PI US 6063306 20000516

AI US 1998-105555 19980626

FI US 6063306 20000516

DT UTILITY; REASSIGNED

FS CHEMICAL

MRN 009377 MFN: 0575

CLMN 34

TI **CHEMICAL MECHANICAL POLISHING SLURRY USEFUL**
 FOR COPPER/**TANTALUM** SUBSTRATE; ABRASIVE, AMINO COMPOUND AND
 COMPLEXING AGENT

AB The present invention is a first **CMP slurry** including
 an abrasive, an oxidizing agent, a complexing agent, a film forming agent
 and an organic amino compound, a second polishing **slurry**
 including an abrasive, an oxidizing agent, and acetic acid wherein the
 weight ratio of the oxidizing agent to acetic acid is at least 10 and a
 method for using the first and second polishing **slurries**
 sequentially to polish a substrate containing copper and containing
tantalum or **tantalum** nitride or both **tantalum**
 and **tantalum** nitride.

ECLM 1. A chemical mechanical polishing **slurry** precursor comprising:
 at least one abrasive; at least one organic amino compound selected from
 long chain alkylamines, alcoholamines and mixtures. . . .

ACLM 2. The chemical mechanical polishing **slurry** precursor of claim
 1 including a film forming agent.

3. The chemical mechanical polishing **slurry** precursor of claim
 1 wherein the complexing agent is selected from the group of compounds
 including acetic acid, citric acid,

4. The chemical mechanical polishing **slurry** precursor of claim
 3 wherein the complexing agent is tartaric acid.

5. The chemical mechanical polishing **slurry** precursor of claim

4 wherein the tartaric acid is present in an amount ranging from 0.5 to

about 5.0 weight. . . .

6. The chemical mechanical polishing **slurry** precursor of claim 2 wherein the film forming agent is benzotriazole.

7. The chemical mechanical polishing **slurry** precursor of claim 6 including from about 0.01 to about 0.2 weight percent benzotriazole.

8. The chemical mechanical polishing **slurry** precursor of claim 1 wherein the **slurry** precursor has a pH of from about 4.0 to about 80

9. The chemical mechanical polishing **slurry** precursor of claim 1 including from about 0.005 wt % to about 10.0 wt % of at least one organic. . . .

10. A chemical mechanical polishing **slurry** comprising: at least one abrasive; at least one oxidizing agent; and at least one organic amino compound selected from long. . . .

11. The chemical mechanical polishing **slurry** of claim 10 including a film forming agent.

12. The chemical mechanical polishing **slurry** of claim 10 including at least one complexing agent.

13. The chemical mechanical polishing **slurry** of claim 11 wherein the film forming agent is benzotriazole.

14. The chemical mechanical polishing **slurry** of claim 13 including from about 0.01 to about 0.2 weight percent benzotriazole.

15. The chemical mechanical polishing **slurry** of claim 10 wherein the **slurry** has a pH of from about 4.0 to about 80

16. The chemical mechanical polishing **slurry** of claim 10 including from about 0.005 wt % to about 10.0 wt % of at least one organic amino. . . .

17. The chemical mechanical polishing **slurry** of claim 10 wherein the abrasive is at least one metal oxide.

18. The chemical mechanical polishing **slurry** of claim 17 wherein the metal oxide abrasive is selected from the group including alumina, ceria, germania, silica, titania, zirconia,

19. The chemical mechanical polishing **slurry** of claim 10 wherein the abrasive is an aqueous dispersion of a metal oxide.

20. The chemical mechanical polishing **slurry** of claim 19 wherein the metal oxide abrasive consists of metal oxide aggregates having a size distribution less than about. . . .

21. The chemical mechanical polishing **slurry** of claim 17 wherein the metal oxide abrasive consists of discrete, individual metal oxide spheres having a primary particle diameter. . . .

22. The chemical mechanical polishing **slurry** of claim 10 wherein the abrasive is selected from the group consisting of precipitated abrasives or fumed abrasives.

23. The chemical mechanical polishing **slurry** of claim 10 wherein the abrasive is an aqueous dispersion of alumina.

24. The chemical mechanical polishing **slurry** precursor of claim 10 wherein the oxidizing agent is selected from hydrogen peroxide, urea hydrogen peroxide, urea, and combinations thereof.

25. The **chemical mechanical polishing slurry** of claim 10 wherein the **slurry** has a Cu:Ta polishing selectivity ratio of at least 40.

26. A chemical mechanical polishing **slurry** comprising: alumina; at least one oxidizing agent; tartaric acid; benzotriazole; and at least one organic amino compound selected from long. . . .

27. The chemical mechanical polishing **slurry** of claim 26 wherein the organic amino compound is dodecylamine.

28. The chemical mechanical polishing **slurry** of claim 26 wherein the organic amino compound is triethanolamine.

29. The chemical mechanical polishing **slurry** of claim 26 wherein the oxidizing agent is selected from hydrogen peroxide, urea hydrogen peroxide, urea, and combinations thereof.

30. A **chemical mechanical polishing slurry** comprising: from about 0.5 to about 15 wt % alumina; from about 0.5 to about 5 wt % tartaric acid; . . . 1 to about 20 wt % urea and from about 1 to about 12.0 wt % hydrogen peroxide wherein the **chemical mechanical polishing slurry** has a pH of from about 4 to about 8 and a Cu:Ta polishing selectivity ratio greater than 10.

31. The chemical mechanical polishing **slurry** of claim 30 including at least one surfactant.

32. The chemical mechanical polishing **slurry** of claim 12 wherein the complexing agent is selected from the group of compounds including acetic acid, citric acid, lactic. . .

33. The chemical mechanical polishing **slurry** of claim 12 wherein the complexing agent is tartaric acid.

34. The chemical mechanical polishing **slurry** of claim 33 wherein the tartaric acid is present in an amount ranging from 0.5 to about 5.0 weight percent.

L36 ANSWER 6 OF 11 IFIPAT COPYRIGHT 2001 IFI
 AN 3303622 IFIPAT;IFIUDB;IFICDB
 TI METHOD FOR SELECTIVE GROWTH OF CU3 GE OR CU5 SI FOR PASSIVATION OF DAMASCENE COPPER STRUCTURES AND DEVICE MANUFACTURED THEREBY; COATING TOP DIELECTRIC LAYER AND TRENCH SURFACES WITH BARRIER LAYER, OVERFILLING TRENCH WITH COPPER, THINNING COPPER LAYER AND PASSIVATING WITH SILICON OR GERMANIUM, POLISHING SURFACE DOWN TO DIELECTRIC AND LEAVING PASSIVATED COPPER IN TRENCH
 INF Bao; Tien-I, Hsin-Chu, TW
 Jang; Syun-Ming, Hsin-Chu, TW
 Liu; Chung-Shi, Hsin-Chu, TW
 Yu; Chen-Hua, Hsin-Chu, TW
 IN Bao Tien-I (TW); Jang Syun-Ming (TW); Liu Chung-Shi (TW); Yu Chen-Hua (TW)
 PAF Taiwan Semiconductor Manufacturing Company, Hsin-Chu, TW
 PA Taiwan Semiconductor Manufacturing Co TW (25218)
 EXNAM Niebling, John F
 EXNAM Gurley, Lynne A
 AG Ackerman, Stephen B.
 Jones, II, Graham S.
 Saile, George O.
 PI US 6046108 20000404 (CITED IN 002 LATER PATENTS)
 AI US 1999-344402 19990625
 XPD 25 Jun 2019
 FI US 6046108 20000404
 DT UTILITY
 FS CHEMICAL
 OS CA 132:244985
 MRN 010067 MFN: 0128
 CLMN 28
 GI 3 Drawing Sheet(s), 6 Figure(s).
 ACLM . . . with an oxidation agent of hydrogen peroxide (H2 O2), nitric acid, hypochlorous acid, chromic acid, ammonia, ammonium salt, and a **slurry** of polishing agent such as alumina (Al2 O3) and deionized water (DI H2 O) plus BTA (BenzoTriAzole).
 . . . with an oxidation agent of hydrogen peroxide (H2 O2), nitric acid, hypochlorous acid, chromic acid, ammonia, ammonium salt, and a **slurry** of polishing agent such as alumina (Al2 O3) and deionized water (DI H2 O) plus BTA (BenzoTriAzole).
 . . . with an oxidation agent of hydrogen peroxide (H2 O2), nitric acid, hypochlorous acid, chromic acid, ammonia, ammonium salt, and a **slurry** of polishing agent such as alumina (Al2 O2) and deionized water (DI H2 O) plus BTA (BenzoTriAzole).

exposed sidewalls of said dielectric layer, forming a barrier layer composed of a material selected from the group consisting of **tantalum** and **tantalum** nitride, said barrier layer being superjacent to, as follows: a) said top surface of said conductive substrate, b) said dielectric. . . barrier layer, said copper conductor overfilling said narrower hole, removing material from said surface of said copper conductor by a **CMP** etching process leaving a lowered copper surface with a thin layer of copper over said barrier layer above said top. . . in said narrower hole in said trench, and then subtracting material from the surface of said copper compound by a **CMP** etching process to planarize said copper compound down to said dielectric top level leaving a thin layer of said compound. . .

with an oxidation agent of hydrogen peroxide (H₂ O₂), nitric acid, hypochlorous acid, chromic acid, ammonia, ammonium salt, and a **slurry** of polishing agent such as alumina (Al₂ O₃) and deionized water (DI H₂ O) plus BTA (BenzoTriAzole).

acid environment with an oxidation agent of hydrogen peroxide, nitric acid, hypochlorous acid, chromic acid, ammonia, ammonium salt, and a **slurry** of polishing agent such as alumina and deionized water plus BenzoTriAzole.

L36 ANSWER 7 OF 11 IFIPAT COPYRIGHT 2001 IFI

AN 3254219 IFIPAT;IFIUDB;IFICDB

TI **CHEMICAL MECHANICAL POLISHING (CMP)**

SLURRY FOR POLISHING COPPER INTERCONNECTS WHICH USE

TANTALUM-BASED BARRIER LAYERS; MULTILAYER INTEGRATED CIRCUIT

INF Bajaj; Rajeev, Fremont, CA

Das; Sanjit, Austin, TX

Farkas; Janos, Austin, TX

Freeman; Melissa, Round Rock, TX

Watts; David K., Austin, TX

IN Bajaj Rajeev; Das Sanjit; Farkas Janos; Freeman Melissa; Watts David K

PAF Motorola, Inc., Schaumburg, IL

PA Motorola Inc (57432)

EXNAM Niebling, John F

EXNAM Zarneke, David A

AG Witek, Keith E.

PI US 6001730 19991214 (CITED IN 010 LATER PATENTS)

AI US 1997-954191 19971020

XPD 20 Oct 2017

FI US 6001730 19991214

DT UTILITY

FS CHEMICAL

MRN 008787 MFN: 0263

009088 0638

CLMN 32

GI 3 Drawing Sheet(s), 6 Figure(s).

TI **CHEMICAL MECHANICAL POLISHING (CMP)**

SLURRY FOR POLISHING COPPER INTERCONNECTS WHICH USE

TANTALUM-BASED BARRIER LAYERS; MULTILAYER INTEGRATED CIRCUIT

ECLM . . . the steps of: providing a dielectric layer having a top surface; forming an opening in the dielectric layer; forming a **tantalum**-based barrier layer within the opening; forming a copper layer over the **tantalum**-based barrier layer; polishing the copper layer until a portion of the **tantalum**-based barrier layer is exposed, the polishing of the copper layer using a first **CMP slurry**; and polishing the **tantalum**-based barrier layer to expose a top surface of the dielectric layer, the polishing of the tantalumbased barrier layer using a second **CMP slurry** different from the first **CMP slurry**, the second **CMP**

- slurry** having a nonneutral pH.
- ACLM 2. The method of claim 1 wherein the first CMP **slurry** is a **slurry** comprising: on an order of 0.2 wt % to 5 wt % of an oxidizing agent; on an order of . . . 20 wt % of a carboxylate salt; and on an order of 1.0 wt % to 12 wt % abrasive **slurry**.
6. The method of claim 1 wherein the first CMP **slurry** also contains 1,2,4-triazole or a triazole derivative.
7. The method of claim 1 wherein the first CMP **slurry** comprises: on an order of 1.0 wt % to 1.5 wt % of hydrogen peroxide; on an order of 0.8. . . 1.3 wt % of a citrate salt; and on an order of 2.0 wt % to 4.0 wt % abrasive **slurry**.
9. The method of claim 1 wherein the second CMP **slurry** comprises: on an order of 1.0 wt % to 12.0 wt % of an abrasive **slurry**; and on an order of 0.01 wt % to 2.0 wt % of an amine compound.
10. The method of claim 9 wherein abrasive **slurry** is a silica abrasive.
11. The method of claim 9 wherein the second CMP **slurry** has a pH between 9 and 11.
12. The method of claim 1 wherein the first CMP **slurry** polishes the copper layer at a rate of greater than 5000 angstroms per minute and polishes the **tantalum**-based barrier layer at a rate of less than 350 angstroms per minute, and wherein the second CMP **slurry** polishes the copper layer at a rate of less than 400 angstroms per minute and polishes the **tantalum**-based barrier layer at a rate of greater than 450 angstroms per minute.
13. The method of claim 1 wherein the first CMP **slurry** is used in conjunction with a first polishing pad and the second CMP **slurry** is used in conjunction with a second polishing pad wherein the second polishing pad is softer than the first polishing.
16. A method of polishing a copper layer having a **tantalum**-based barrier layer, the method comprising the steps of: providing a dielectric layer; forming an opening in the dielectric layer; forming the **tantalum**-based barrier layer within the opening; forming the copper layer over the **tantalum**-based barrier layer; polishing the copper layer using a first CMP process comprising a carboxylate salt; and polishing the **tantalum**-based barrier layer using a second CMP process comprising an amine compound.
18. The method of claim 16 wherein the first CMP process uses a first CMP **slurry** and the second CMP process uses a second CMP **slurry** wherein the first CMP **slurry** is different from the second CMP **slurry**.
19. The method of claim 18 wherein the first CMP **slurry** comprises: on an order of 0.2 wt % to 5 wt % of an oxidizing agent; on an order of . . . 20 wt % of a carboxylate salt; and on an order of 1.0 wt % to 12 wt % abrasive **slurry**; and the second CMP **slurry** comprises: on an order of 1.0 wt % to 12.0 wt % of an abrasive **slurry**; and on an order of 0.01 wt % to 2.0 wt % of an amine compound.
20. The method of claim 18 wherein the first CMP **slurry** comprises an alumina abrasive **slurry** and the second CMP **slurry** comprises a silica abrasive **slurry**.
21. The method of claim 18 wherein the first CMP **slurry** comprises an alumina abrasive **slurry** and the second CMP **slurry** comprises a silica abrasive **slurry**.
22. The method of claim 18 wherein the first CMP **slurry** comprises an oxidizing agent and the second CMP **slurry** does not contain an oxidizing agent.
23. The method of claim 18 wherein the first CMP **slurry** polishes the copper layer at a rate of greater than 5000 angstroms per minute and polishes the **tantalum**-based barrier layer at a rate

of less than 350 angstroms per minute, and wherein the second **CMP slurry** polishes the copper layer at a rate of less than 400 angstroms per minute and polishes the **tantalum**-based barrier layer at a rate of greater than 450 angstroms per minute.

24. The method of claim 18 wherein the second **CMP slurry** comprises ethylenediamine.

26. A method for forming a copper layer having a **tantalum**-based barrier layer, the method comprising the steps of: forming a first dielectric layer; forming a second dielectric layer over the. . . etching an interconnect trench in the second dielectric layer; etching a via opening in the first dielectric layer; depositing the **tantalum**-based barrier layer within the interconnect trench and the via opening; depositing the copper layer on top of the **tantalum**-based barrier layer; polishing, using a first **CMP** process, the copper layer to expose a portion of the **tantalum**-based barrier layer, the first **CMP** process polishing the copper layer faster than the **tantalum**-based barrier layer; and polishing, using a second **CMP** process different from the first **CMP** process, the **tantalum**-based barrier layer to expose the top surface of the second dielectric layer, the second **CMP** process polishing the **tantalum**-based barrier layer faster than the copper layer and polishing the **tantalum**-based barrier layer faster than the second dielectric layer wherein the first **CMP slurry** is used in conjunction with a first polishing pad and the second **CMP slurry** is used in conjunction with a second polishing pad wherein the second polishing pad is softer than the first polishing. . .

27. The method of claim 26 wherein the first **CMP** process uses a **slurry** comprising: on an order of 0.2 wt % to 5 wt % of hydrogen peroxide; on an order of 0.2. . . 20 wt % of a ammonium citrate; and on an order of 1.0 wt % to 12 wt % alumina **slurry**; and the second **CMP** process uses a **slurry** comprising: on an order of 1.0 wt % to 12.0 wt % of a silica **slurry**; and on an order of 0.01 wt % to 2.0 wt % of ethylenediamine.

28. The method of claim 27 wherein the second **CMP** process uses a **slurry** that has a non-neutral basic pH.

29. The method of claim 28 wherein the second **CMP** process uses a **slurry** that has a non-neutral basic pH within a range of 9.0 and 11.0

31. The method of claim 30 wherein the first **CMP** process uses a **slurry** comprising: on an order of 0.2 wt % to 5 wt % of hydrogen peroxide; on an order of 0.2. . . 20 wt % of a ammonium citrate; and on an order of 1.0 wt % to 12 wt % alumina **slurry**; and the second **CMP** process uses a **slurry** comprising: on an order of 1.0 wt % to 12.0 wt % of a silica **slurry**; and on an order of 0.01 wt % to 2.0 wt % of ethylenediamine; and the third **CMP** process uses a **slurry** comprising: KOH; and deionized H₂ O.

L36 ANSWER 8 OF 11 IFIPAT COPYRIGHT 2001 IFI

AN 3072213 IFIPAT;IFIUDB;IFICDB

TI TWO-STAGE PROCESS FOR ELECTROLYTICALLY POLISHING METAL SURFACES TO OBTAIN IMPROVED OPTICAL PROPERTIES AND RESULTING PRODUCTS; FIRST CONVENTIONAL POLISHING BY CHEMICAL OR ELECTROLYTIC MEANS AND A SECOND ANODIZING STEP BY MINERAL, ORGANIC OR MIXED ACIDS

INF Allegret, Francis, Goncelin, FR

IN Allegret Francis (FR)

PAF Satma, Concelin, FR

PA Traitement des Metaux et Alliages (Satma) FR (2085)

EXNAM Valentine, Donald R

AG Dennison, Meserole, Pollack & Scheiner

PI US 5837117 19981117

AI US 1996-646386 19960508
 XPD 8 May 2016
 FI US 5837117 19981117
 DT UTILITY
 FS CHEMICAL
 MRN 008041 MFN: 0909
 CLMN 17

AB A process for polishing a metal surface, typically based on Al, Mg, Ta, Ti, Zr, Hf or their alloys, comprises a first conventional polishing step by chemical or electrolytic means and a second electrolytic micro-polishing step by anodizing in a mineral, organic or mixed acid solution to form a oxide layer of the barrier type having a thickness between 100 and 500 nm.

L36 ANSWER 9 OF 11 IFIPAT COPYRIGHT 2001 IFI

AN 3058222 IFIPAT;IFIUDB;IFICDB

TI PROTECTED ENCAPSULATION OF CATALYTIC LAYER FOR ELECTROLESS COPPER INTERCONNECT; ELECTROLESS METALLIZATION

INF Desilva, Melvin, Dallas, TX
 Dubin, Valery M., Cupertino, CA
 Schacham-Diamand, Yosef, Ithaca, NY
 Ting, Chiu H., Saratoga, CA
 Vasudev, Prahalad K., Austin, TX
 Zhao, Bin, Austin, TX

IN Desilva Melvin; Dubin Valery M; Schacham-Diamand Yosef; Ting Chiu H; Vasudev Prahalad K; Zhao Bin

PAF Cornell Research Foundation, Inc., Ithaca, NY
 Intel Corporation, Santa Clara, CA
 Sematech, Inc., Austin, TX

PA Cornell Research Foundation Inc
 Intel Corp
 Sematech Inc
 (20656, 27981, 42458)

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PI US 5824599 19981020 (CITED IN 015 LATER PATENTS)

AI US 1996-587264 19960116

XPD 16 Jan 2016

FI US 5824599 19981020

DT UTILITY

FS CHEMICAL

OS CA 129:309595

MRN 008003 MFN: 0843

008003 0845

008003 0851

008003 0860

009054 0989

CLMN 22

GI 9 Drawing Sheet(s), 20 Figure(s).

AB . . . on a semiconductor. Once a via or a trench is formed in a dielectric layer, a titanium nitride (TiN) or tantalum (Ta) barrier layer is deposited. Then, a catalytic copper seed layer is conformally blanket deposited in vacuum over the barrier layer. . . from oxidizing. An electroless deposition technique is then used to autocatalytically deposit copper on the catalytic layer. The electroless deposition solution dissolves the overlying protective layer to expose the surface of the underlying catalytic layer. The electroless copper deposition occurs on. . . surface, and continues until the via/trench is filled. Subsequently, the copper and barrier material are polished by an application of chemical-mechanical polishing (CMP) to remove excess copper and barrier

material from the surface, so that the only copper and barrier material remaining are. . . to form a dielectric barrier layer. The copper interconnect is fully encapsulated from the adjacent material by the TiN (or Ta) barrier layer and the overlying SiN layer.

L36 ANSWER 10 OF 11 IFIPAT COPYRIGHT 2001 IFI
AN 2894353 IFIPAT;IFIUDB;IFICDB
TI SELECTIVE POLISH PROCESS FOR TITANIUM, TITANIUM NITRIDE, TANTALUM AND
TANTALUM NITRIDE
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EXNAM Rose, Robert A
EXNAM Nguyen, George
AG Heslin & Rothenberg, P.C.
PI US 5676587 19971014 (CITED IN 013 LATER PATENTS)
AI US 1995-568162 19951206
XPD 6 Dec 2015
FI US 5676587 19971014
DT UTILITY
FS MECHANICAL
MRN 007798 MFN: 0885
CLMN 5
GI 3 Drawing Sheet(s), 5 Figure(s).
AB An improved Chemical Mechanical Planarization (CMP) method is provided for selectively removing a layer of metallization material such as tungsten or copper and a liner film such as Ti/Tin or Ta/TaN from the surface of an oxide layer of a semiconductor wafer. The method includes removing the metallization and liner layers with a first removal process which utilizes CMP polishing and an alumina-based slurry. The first removal process is stopped after the metallization layer is completely removed and before the liner film is completely removed. The remainder of the liner film is removed using a second removal process which includes CMP polishing using a neutral pH silica-based slurry which is selective to the liner film.

L36 ANSWER 11 OF 11 IFIPAT COPYRIGHT 2001 IFI
AN 1152920 IFIPAT;IFIUDB;IFICDB
TI HOMOGENEOUS MULTILAYER DIELECTRIC MIRROR AND METHOD OF MAKING SAME;
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PI US 4101707 19780718 (CITED IN 004 LATER PATENTS)
AI US 1977-784394 19770404
XPD 4 Apr 1997
FI US 4101707 19780718
DT UTILITY
FS CHEMICAL
OS CA 89:207180

CLMN 3

GI 1 Drawing Sheet(s), 1 Figure(s).

ECLM . . . A GARNET SUBSTRATE HAVING A SUBSTANTIALLY RECTANGULAR CROSSSECTION WHEREIN AT LEAST ONE SIDE OF SAID SUBSTRATE IS A MIRROR SURFACE **CHEMICAL-MECHANICAL POLISHED** TO BE A RELATIVELY FREE OF INHOMOGENEOUS STRAIN AND WHEREIN SAID GARNET IS A METAL OXIDE HAVING THE GENERAL FORMULA. . . ONE ELEMENT SELECTED FROM THE GROUP CONSISTING OF GALLIUM, INDIUM, SCANDIUM, TITANIUM, VANADIUM, CHROMIUM, MANGANESE, RHODIUM, ZIRCONIUM, HAFNIUM, MOLYBDENUM, NIOBIUM, **TANTALUM**, TUNGSTEN, AND ALLUMINUM, AND A MIRROR COATING DEPOSITED ON SAID MIRROR SURFACE OF SAID SUBSTRATE, SAID MIRROR COATING CONSISTING OF. . .

ACLM . . . a substantially rectangular cross-section; polishing a selected side of said substrate to form a mirror surface thereon; providing an abrasive **slurry**; adjusting the pH of said abrasive **slurry** by the addition thereto of an etchant for said garnet; final polishing said mirror surface of said garnet substrate using said pH-adjusted abrasive **slurry**; and depositing a mirror coating on said mirror surface of said substrate, said mirror coating consisting of a first plurality. . .

L4 22862 SEA FILE=WPIX 1,2,4-TRIAZOLE OR BENZOTRIAZOLE OR IMIDAZOLE OR
5-METHYLBENZIMIDAZOLE OR POLYANILINE OR INDAZOLE OR PURINE OR
BTA
L5 22270 SEA FILE=WPIX PVA OR PAA OR GEO OR GPO OR DCA OR PEI OR
DMSIO-EO
L6 269703 SEA FILE=WPIX POLYVINYL ALCOHOL OR VINYL ACETATE OR POLYETHYLEN
E OR SORBITOL OR GLYCEROL OR POLYACRYLAMIDE OR ETHYLENE GLYCOL
OR GLYCEROL ETHOXYLATE OR DIMETHYLSILOXANE ETHYLENE OXIDE OR
POLYETHYLENE OXIDE OR POLYOXYETHYLENE OR GLYCEROL PROPOXYLATE
OR ?HEXYLAMINE OR POLYETHYLENEIMINE
L9 29624 SEA FILE=WPIX TA OR TANTALUM
L29 2788 SEA FILE=INSPEC CMP OR CHEM? (3A) POLISH?
L33 342 SEA FILE=IFIPAT L4 (S) (L5 OR L6)
L34 30 SEA FILE=IFIPAT L9 (S) L29
L36 11 SEA FILE=IFIPAT (L33 OR SOLUTION OR SLURR?) (L) L34
L37 7028 SEA FILE=IFIPAT (CIRCUIT? OR WAFER OR PLATEN) (L) (L33 OR
SOLUTION OR SLURR?)
L41 432 SEA FILE=IFIPAT L37 (L) L29
L42 30 SEA FILE=IFIPAT (TA OR TANTALUM) AND L41
L45 146887 SEA FILE=IFIPAT ORGANIC OR (ORG? (1A) (ADDITIVE OR SOLUTION))
L46 9 SEA FILE=IFIPAT L45 AND L42
L47 8 SEA FILE=IFIPAT L46 NOT L36

=> d bib, kwic 1-

YOU HAVE REQUESTED DATA FROM 8 ANSWERS - CONTINUE? Y/(N):Y

L47 ANSWER 1 OF 8 IFIPAT COPYRIGHT 2001 IFI

AN 3487309 IFIPAT;IFIUDB;IFICDB

TI OPTIMIZED TRENCH/VIA PROFILE FOR DAMASCENE FILLING

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PI US 6211071 20010403

AI US 1999-296552 19990422

XPD 22 Apr 2019

FI US 6211071 20010403

DT UTILITY

FS CHEMICAL

CLMN 18

GI 4 Drawing Sheet(s), 7 Figure(s).

ACLM 3. The method as in claim 2, further comprising planarizing the
recess-filled surface of said substrate by **chemical-mechanical
polishing (CMP)**.

7. The method as in claim 5, wherein said substrate comprises a
semiconductor **wafer** of monocrystalline silicon or gallium
arsenide having a surface, comprising forming said dielectric layer on
said **wafer** surface, and said at least one recess formed therein
comprises a plurality of recesses of different widths and/or depths for
providing vias, interlevel metallization, and/or interconnection routing
of at least one active device region or component of said semiconductor
wafer.

inorganic-based dielectric material selected from an oxide, nitride,
and oxynitride of silicon, and from a second, upper portion comprising an
organic-based or derived low dielectric constant material
selected from hydrogen silsesquioxane (HSQ), tetraethyl orthosilicate

(TEOS), benzocyclobutene (BCB), parylene, and polyimide.

.. conductive material comprising a metal selected from the group consisting of copper, chromium, nickel, cobalt, gold, silver, aluminum, tungsten, titanium, **tantalum**, and alloys thereof.

12. The method as in claim 11, comprising providing said adhesion/barrier layer as a material selected from titanium, tungsten, chromium, **tantalum**, and **tantalum** nitride.

.. a semiconductor device, which method comprises the sequential steps of: forming a dielectric layer on a surface of a semiconductor **wafer** substrate, said dielectric layer comprising a first, lower portion of a first dielectric material having a first thickness in contact with said **wafer** surface and a second, upper portion of a second dielectric material having a second thickness on said first, lower portion;..

15. The method as in claim 14, comprising providing a **wafer** of monocrystalline silicon or gallium arsenide having integrated **circuitry** formed therein or thereon; said first, lower portion of said dielectric layer comprises an inorganic-based dielectric material selected from an oxide, nitride, and oxynitride of silicon; said second, upper portion of said dielectric layer comprises an **organic** -based or derived low dielectric constant material selected from hydrogen silsesquioxane (HSQ), tetraethyl orthosilicate (TEOS), benzocyclobutene (BCB), parylene, and polyimide; and. . . recesses formed therein are of different widths and/or depths for providing vias, interlevel metallization, and/or interconnection routing of said integrated **circuitry**; said nucleation/seed layer comprises a refractory metal, copper, or a copper-based alloy; and said layer of electrically conductive material comprises. . .

17. The method as in claim 15, further comprising planarizing the copper or copper-based alloy-filled recesses by **chemical chemical-mechanical polishing** utilizing an alumina-based **slurry**.

18. The method as in claim 17, comprising providing at least said recess surface portions (a), (b), and (c) with an adhesion promoting and/or diffusion barrier layer selected from titanium, tungsten, chromium, **tantalum**, and **tantalum** nitride prior to providing said nucleation/seed layer thereon.

L47 ANSWER 2 OF 8 IFIPAT COPYRIGHT 2001 IFI

AN 3457651 IFIPAT;IFIUDB;IFICDB

TI METHOD OF MAKING EMBEDDED WIRING SYSTEM

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PI US 6184124 20010206

AI US 1998-78510 19980514

XPD 18 Sep 2016

RLI US 1996-715446 19960918 DIVISION

5793112

PRAI JP 1996-89507 19960411

FI US 6184124 20010206

US 5793112

DT UTILITY

FS CHEMICAL

CLMN 9

GI 9 Drawing Sheet(s), 34 Figure(s).
ECLM . . . A W I N G

1. A method of preparing a multilevel embedded wiring system for an integrated **circuit** (IC) comprising a first wiring formation step, a first connecting portion formation step, and a second wiring formation step, wherein. . . material on the first insulating layer and in the first trench, flattening a top surface of the conductive material by **Chemical Mechanical Polishing** (**CMP**) to leave the conductive material only in the first trench, forming a recess in the conductive material in the first. . .

ACLM 4. The method of preparing a multilevel embedded wiring system according to claim 1, including forming the recess by **CMP** overetching.

. . . method of preparing a multilevel embedded wiring system according to claim 4, wherein the **CMF** over-etching process uses an etching **solution** comprising an **organic** acid, such as propionic acid, acetic acid, picric acid, and salicylic acid, and hydrogen peroxide.

. . . embedded wiring system according to claim 1, wherein the conductive capping layer is selected from the group consisting of Ti, **Ta**, Mo, Cr, Al, W, and alloys, oxides, and nitrides of at least one member of the group.

L47 ANSWER 3 OF 8 IFIPAT COPYRIGHT 2001 IFI

AN 3387799 IFIPAT;IFIUDB;IFICDB

TI SPUTTER-RESISTANT HARDMASK FOR DAMASCENE TRENCH/VIA FORMATION

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PI US 6121150 20000919

AI US 1999-296557 19990422

XPD 22 Apr 2019

FI US 6121150 20000919

DT UTILITY

FS CHEMICAL

OS CA 133:231505

MRN 009913 MFN: 0331

CLMN 20

GI 3 Drawing Sheet(s), 9 Figure(s).

ACLM 2. The method as in claim 1, comprising providing a workpiece including a semiconductor **wafer** substrate with a dielectric layer formed thereon, said dielectric layer comprising said workpiece surface.

. . . forming said dielectric layer from a dielectric material selected from inorganic-based oxides, nitrides, and oxynitrides of silicon, or from an **organic**-based or derived low dielectric constant material selected from hydrogen silsesquioxane, tetraethyl orthosilicate, benzocyclobutene, parylene, and polyimide.

. . . claim 1, comprising forming said sputter-resistant hardmask layer from a high atomic mass metallic element or nitride thereof selected from **tantalum** (**Ta**), tungsten (W), titanium (Ti), **tantalum** nitride (TaN), tungsten nitride (WN), and titanium nitride (TiN).

. . . filling said at least one recess with a layer of an electrically conductive material comprising a metal selected from Ti, **Ta**, W, aluminum (Al), chromium (Cr), nickel (Ni), cobalt (Co), silver (ag), gold (Au), copper (Cu), and their alloys.

. . . of said at least one recess with at least one of an adhesion/barrier layer comprising a material selected from Cr, **Ta**, and TaN and a

nucleation/seed layer comprising at least one material selected from refractory metals, Cu, and Cu-based alloys prior.

12. The method as in claim 1, comprising planarizing the recess-filled surface of said workpiece by **chemical-mechanical polishing**.

13. The method as in claim 2, wherein said substrate comprises a semiconductor **wafer** of monocrystalline silicon (Si) or gallium arsenide (GaAs) having a surface, comprising forming said dielectric layer on said **wafer** surface, and said at least one recess formed therein comprises a plurality of recesses of different widths and depths for providing vias, interlevel metallization, and interconnection routing of at least one active device region or component of said semiconductor **wafer**.

14. The method as in claim 13, wherein said method comprises the sequential steps of: forming a dielectric layer on a surface of a semiconductor **wafer** substrate, said dielectric layer having an exposed surface; forming a sputter-resistant hardmask layer on said exposed surface of said dielectric.

16. The method as in claim 15, comprising providing a **wafer** of monocrystalline Si or GaAs having integrated **circuitry** formed therein or thereon; said dielectric layer comprises a dielectric material selected from inorganic-based oxides, nitrides, and oxynitrides of Si or from an **organic**-based or derived low dielectric constant material selected from hydrogen silsesquioxane, tetraethyl orthosilicate, benzocyclobutene, parylene, and polyimide; said sputter-resistant hardmask layer comprises a high atomic mass metallic element or nitride thereof selected from Ta, W, Ti, TaN, WN, and TiN; said plurality of recesses are of different widths and depths for providing vias, interlevel metallization, and/or interconnection routing of said integrated **circuitry**; and said layer of electrically conductive material filling said plurality of recesses comprises Cu or a Cu-based alloy.

17. The method as in claim 16, wherein said method further comprises forming surfaces of said plurality of recesses with at least one of an adhesion/barrier layer comprising a material selected from Cr, Ta, and TaN and a nucleation/seed layer comprising at least one material selected from refractory metals, Cu, and Cu-based alloys prior.

19. The method as in claim 16, comprising planarizing the Cu or Cu-based alloy-filled recesses by **chemical-mechanical polishing** utilizing an alumina-based **slurry**.

20. An integrated **circuit** semiconductor device fabricated by the method of claim 18.

L47 ANSWER 4 OF 8 IFIPAT COPYRIGHT 2001 IFI
AN 3387798 IFIPAT;IFIUDB;IFICDB
TI OPTIMIZED TRENCH/VIA PROFILE FOR DAMASCENE FILLING
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PI US 6121149 20000919
AI US 1999-296554 19990422
XPD 22 Apr 2019
FI US 6121149 20000919
DT UTILITY
FS CHEMICAL
OS CA 133:231504
MRN 009913 MFN: 0362
CLMN 20

- GI 4 Drawing Sheet(s), 7 Figure(s).
- ACLM 3. The method as in claim 2, further comprising planarizing the recess-filled surface of said substrate by **chemical-mechanical polishing**.
6. The method as in claim 1, wherein said substrate comprises a semiconductor **wafer** of monocrystalline silicon or gallium arsenide having a surface, comprising forming said dielectric layer on said **wafer** surface, and said at least one recess formed therein comprises a plurality of recesses of different widths and depths for providing vias, interlevel metallization, and interconnection routing of at least one active device region or component of said semiconductor **wafer**.
- 6, comprising forming said dielectric layer from an undoped dielectric material comprising an oxide or nitride of silicon, or an **organic** polymeric material and introducing dopant impurities into the surface of said dielectric layer, said dopant impurities penetrating said dielectric layer.
- from a first, lower portion comprising an undoped dielectric material selected from an oxide or nitride of silicon, and an **organic** polymeric material, and from a second, upper portion comprising a doped dielectric material selected from boron-, phosphorus-, and boron+phosphorus-doped silicate.
- conductive material comprising a metal selected from the group consisting of copper, chromium, nickel, cobalt, gold, silver, aluminum, tungsten, titanium, **tantalum**, and alloys thereof.
12. The method as in claim 11, comprising providing said adhesion/barrier layer as a material selected from titanium, tungsten, chromium, **tantalum**, and **tantalum** nitride.
- a semiconductor device, which method comprises the sequential steps of: forming a dielectric layer on a surface of a semiconductor **wafer** substrate, said dielectric layer comprising a first, lower portion of first thickness in contact with said **wafer** surface and a second, upper portion of second thickness on said first, lower portion; wherein said second, upper portion comprises.
16. The method as in claim 15, comprising providing a **wafer** of monocrystalline silicon or gallium arsenide having integrated **circuitry** formed therein or thereon; said first, lower portion of said dielectric layer comprises an undoped dielectric material selected from an oxide or nitride of silicon and an **organic** polymeric material; said second, upper portion of said dielectric layer comprises a doped dielectric material selected from an impurity-doped oxide or nitride of silicon, an **organic** polymeric material, and a boron-, phosphorus-, or boron+phosphorus-doped silicate glass; and said plurality of recesses formed therein are of different widths and depths for providing vias, interlevel metallization, and interconnection routing of said integrated **circuitry**; said nucleation/seed layer comprises a refractory metal, copper, or a copper-based alloy; and said layer of electrically conductive material comprises.
18. The method as in claim 16, further comprising planarizing the copper or copper-based alloy-filled recesses by **chemical chemical-mechanical polishing** utilizing an alumina-based **slurry**.
19. The method as in claim 18, comprising providing at least said recess surface portions (a), (b), and (c) with an adhesion promoting/diffusion barrier layer selected from titanium, tungsten, chromium, **tantalum**, and **tantalum** nitride prior to providing said nucleation/seed layer thereon.
20. An integrated **circuit** semiconductor device fabricated by the method of claim 19.

L47 ANSWER 5 OF 8 IFIPAT COPYRIGHT 2001 IFI

AN 3384284 IFIPAT;IFIUDB;IFICDB
TI OPTIMIZED TRENCH/VIA PROFILE FOR DAMASCENE FILLING
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PI US 6117782 20000912

AI US 1999-296556 19990422

XPD 22 Apr 2019

FI US 6117782 20000912

DT UTILITY

FS CHEMICAL

OS CA 133:201885

MRN 009913 MFN: 0305

CLMN 20

GI 5 Drawing Sheet(s), 8 Figure(s).

ACLM 2. The method as in claim 1, comprising planarizing the recess-filled surface of said substrate by **chemical-mechanical**

polishing.

7. The method as in claim 5, wherein said substrate comprises a semiconductor **wafer** of monocrystalline silicon or gallium arsenide having a surface, comprising forming said dielectric layer on said **wafer** surface, and said at least one recess formed therein comprises a plurality of recesses of different widths and depths for providing vias, interlevel metallization, and interconnection routing of at least one active device region or component of said semiconductor **wafer**.

... said dielectric layer from a first, lower portion comprising a dielectric material selected from an oxide of silicon or an **organic**-based or derived low dielectric constant material selected from hydrogen silsesquioxane (HSQ), tetraethyl orthosilicate (TEOS), benzocyclobutene (BCB), parylene, and polyimide, and. . .

... conductive material comprising a metal selected from the group consisting of copper, chromium, nickel, cobalt, gold, silver, aluminum, tungsten, titanium, **tantalum**, and alloys thereof.

12. The method as in claim 11, comprising providing said adhesion/barrier layer as a material selected from titanium, tungsten, chromium, **tantalum**, and **tantalum** nitride.

... a semiconductor device, which method comprises the sequential steps of: forming a dielectric layer on a surface of a semiconductor **wafer** substrate, said dielectric layer comprising a first, lower portion of a first dielectric material having a first thickness in contact with said **wafer** surface and a second, upper portion of a second dielectric material having a second thickness on said first, lower portion;. . .

16. The method as in claim 15, comprising providing a **wafer** of monocrystalline silicon or gallium arsenide having integrated **circuitry** formed therein or thereon; said first, lower portion of said dielectric layer comprises an oxide of silicon or an **organic**-based or derived low dielectric constant material selected from hydrogen silsesquioxane (HSQ), tetraethyl orthosilicate (TEOS), benzocyclobutene (BCB), parylene, and polyimide; said. . . plurality of recesses are of different widths and depths for providing vias, interlevel metallization, and interconnection routing of said integrated **circuitry**; said nucleation/seed layer comprises a refractory metal, copper, or a copper-based alloy; and said layer of electrically conductive material comprises. . .

18. The method as in claim 16, comprising planarizing the copper or

copper-based alloy-filled recesses by **chemical chemical**
-mechanical **polishing** utilizing an alumina-based **slurry**

19. The method as in claim 18, comprising providing at least said recess surface portions (a), (b), and (c) with an adhesion promoting/diffusion barrier layer selected from titanium, tungsten, chromium, **tantalum**, and **tantalum** nitride prior to providing said nucleation/seed layer thereon.

20. An integrated **circuit** semiconductor device fabricated by the method of claim 19.

L47 ANSWER 6 OF 8 IFIPAT COPYRIGHT 2001 IFI

AN 3384283 IFIPAT;IFIUDB;IFICDB

TI OPTIMIZED TRENCH/VIA PROFILE FOR DAMASCENE PROCESSING

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AI US 1999-296553 19990422

XPD 22 Apr 2019

FI US 6117781 20000912

DT UTILITY

FS CHEMICAL

OS CA 133:216547

MRN 009913 MFN: 0370

CLMN 19

GI 5 Drawing Sheet(s), 9 Figure(s).

ACLM 3. The method as in claim 2, further comprising planarizing the recess-filled surface of said substrate by **chemical-mechanical polishing (CMP)**.

6. The method as in claim 1, comprising providing a semiconductor **wafer** substrate having a dielectric layer formed thereon and comprising said surface, and said at least one recess formed therein comprises. . . for providing vias, interlevel metallization, and/or interconnection routing of at least one active device region or component of said semiconductor **wafer**.

7. The method as in claim 6, comprising providing a **wafer** of monocrystalline silicon or gallium arsenide having integrated **circuitry** formed therein or thereon, and said dielectric layer comprises an oxide or nitride of silicon, or an **organic** polymeric material.

. . . conductive material comprising a metal selected from the group consisting of copper, chromium, nickel, cobalt, gold, silver, aluminum, tungsten, titanium, **tantalum**, and alloys thereof.

. . . 11. The method as in claim 10, comprising providing said adhesion/barrier layer as a material selected from titanium, tungsten, chromium, **tantalum**, and **tantalum** nitride.

. . . forming a plurality of spaced-apart, high aspect ratio recesses in the surface of a dielectric layer formed on a semiconductor **wafer** substrate, with non-recessed surface areas of said dielectric layer therebetween, wherein each said recess comprises: (a) a mouth surface portion. . .

15. The method as in claim 14, comprising providing a **wafer** of monocrystalline silicon or gallium arsenide having integrated **circuitry** formed therein or thereon; said dielectric layer comprises an oxide or nitride of silicon or an **organic** polymeric material; said plurality of recesses formed therein are of

different widths and depths for providing vias, interlevel metallization, and interconnection routing of said integrated **circuitry**; said nucleation/seed layer comprises a refractory metal, copper, or a copper-based alloy; and said layer of electrically conductive material comprises. . .

17. The method as in claim 15, further comprising planarizing the copper or copper-based alloy-filled recesses by **chemical** chemical-mechanical **polishing** utilizing an alumina-based **slurry**.

18. The method as in claim 17, comprising providing at least said recess surface portions (a), (b), and (c) with an adhesion promoting/diffusion barrier layer selected from titanium, tungsten, chromium, **tantalum**, and **tantalum** nitride prior to providing said nucleation/seed layer thereon.

19. An integrated **circuit** semiconductor device fabricated by the method of claim 18.

L47 ANSWER 7 OF 8 IFIPAT COPYRIGHT 2001 IFI

AN 3120749 IFIPAT;IFIUDB;IFICDB

TI METHOD FOR MANUFACTURING A LOW DIELECTRIC CONSTANT INTER-LEVEL INTEGRATED CIRCUIT STRUCTURE; FORMING DIELECTRIC LAYER, CONDUCTIVE REGIONS, REMOVING INTERMEDIATE PORTIONS OF DIELECTRIC LAYER TO FORM GAP, FORMING SECOND DIELECTRIC LAYER, FILLING GAP, POLISHING

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PI US 5880018 19990309 (CITED IN 021 LATER PATENTS)

AI US 1996-727159 19961007

XPD 7 Oct 2016

FI US 5880018 19990309

DT UTILITY

FS CHEMICAL

MRN 008229 MFN: 0201

CLMN 50

GI 5 Drawing Sheet(s), 16 Figure(s).

ACLM . . . of claim 1 wherein the step of forming the second dielectric layer comprises: forming the second dielectric layer as an **organic** dielectric.

. . . comprises: forming the refractory metal barrier from a material selected from a group consisting of: titanium nitride, titanium tungsten, titanium, **tantalum**, **tantalum** nitride, **tantalum** silicon nitride, titanium silicon nitride, and tungsten nitride.

. . . a top portion of the second dielectric layer by polishing a top portion of the second dielectric layer using a **chemical** mechanical **polish** process.

. . . The method of claim 1 further comprising: removing the intermediate portion of the first dielectric layer using a buffered HF **solution**.

. . . comprises: forming the refractory metal barrier from a material selected from a group consisting of: titanium nitride, titanium tungsten, titanium, **tantalum**, **tantalum** nitride, **tantalum** silicon nitride, titanium silicon nitride, and tungsten nitride.

. . . layer comprises: forming the second dielectric layer as a spin-on

polyimide selected from a group consisting of: poly (amic) acid **solution** and fully imidized polyimide.

of: a spin-on polyimide material, a PPQ spin-on polymer, and a material selected from a group consisting of poly(amic) acid **solution** and fully imidized polyimide.

44. A method for forming an integrated **circuit** structure comprising the steps of: providing a semiconductor substrate; forming a first dielectric layer overlying the semiconductor substrate; forming a

L47 ANSWER 8 OF 8 IFIPAT COPYRIGHT 2001 IFI

AN 3096866 IFIPAT;IFIUDB;IFICDB

TI CHEMICAL MECHANICAL POLISHING SLURRY FOR METAL LAYERS AND FILMS; CHEMICAL MECHANICAL POLISHING A THIN LAYER OF METAL OR ALLOY WITH A SLURRY CONTAINING AN ABRASIVE, AN OXIDIZING AGENT, AND SUCCINIC ACID

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GI 3 Drawing Sheet(s), 3 Figure(s).

AB A **polishing slurry** for **chemically**

mechanically **polishing** metal layers and films during the various stages of multilevel interconnect fabrication associated with integrated **circuit** manufacturing. The **slurry** includes an aqueous medium, an abrasive, an oxidizing agent, and an **organic** acid. The polishing **slurry** has been found to significantly lower or inhibit the silicon dioxide polishing rate, thus yielding enhanced selectivity. In addition, the polishing **slurry** is useful in providing effective polishing to metal layers at desired polishing rates while minimizing surface imperfections and defects. Also disclosed is a method for producing coplanar metal/insulator films on a substrate utilizing the **slurry** of the present invention and **chemical** mechanical **polishing** technique relating thereto.

ACLM . . . method of claim 1, wherein said metal layer or thin-film is selected from the group consisting of: aluminum, copper, titanium, **tantalum**, and alloys thereof.

. . . layer or thin-film further comprises at least one underlayer selected from the group consisting of titanium, titanium nitride, titanium tungsten, **tantalum**, and mixtures thereof.

. . . layer on thin-film further comprises at least one underlayer selected from the group consisting of: titanium, titanium nitride, titanium tungsten, **tantalum**, and mixtures thereof.